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PITMAN'S COMMON COMMODITIES
AND INDUSTRIES

THE BOOT AND SHOE INDUSTRY

BY

J. S. HARDING, F.B.S.I.

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TECHNOLOGY, LEEDS TECHNICAL COLLEGE

SECOND EDITION

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PREFACE

BEFORE the advent of machinery, the Boot and Shoe Industry was generally recognized as a craft. Now, however, it is a complex and highly specialized industry.

In writing this book, the author has attempted to present the detail in a concise form, with a view to making it of general popular interest. For this reason many technical features have been eliminated.

The author desires to thank the British United Shoe Machinery Company, Limited, the Singer Sewing Machine Company, Limited, and Messrs. Mobbs and Lewis, Limited, for the loan of blocks used in the production of this work.

The author is also greatly indebted to H. Bradley, Esq., D.I.C., A.R.C.S., B.Sc., F. W. Roberts, Esq., F.B.S.I., R. H. Brookes, Esq., F.B.S.I., A. F. Neve, Esq., F.B.S.I., F. P. Wootton, Esq., A.B.S.I., and Miss Ruth Tomlinson, M.B.E., for the loan of illustrations, or for assistance in compiling the special sections of this work.

J. S. H.

LEEDS, 1931

CONTENTS

CHAP. PAGE

PREFACE iii

I. HISTORY AND CRAFT 1

II. TYPES OF FEET AND LASTS 5

III. CLASSIFICATION AND MEASUREMENT OF FEET AND LASTS 13

IV. PATTERN DESIGNING AND MAKING . . . 23

V. CLICKING 50

VI. PREPARATION FOR CLOSING 74

VII. UPPER CLOSING 82

VIII. BOTTOM STOCK CUTTING AND PREPARATION . 97

IX. LASTING 117

X. BOTTOMING 135

XI. FINISHING 163

XII. THE STOCK ROOM 182

XIII. FACTORY MANAGEMENT 187

XIV. RESEARCH AND EDUCATION 197

XV. THE RELATION BETWEEN CAPITAL AND LABOUR 205

INDEX 211

THE BOOT AND SHOE INDUSTRY

CHAPTER I

HISTORY AND CRAFT

FOOT coverings were in vogue as early as 1600 B.C., and we read that the foot covering of the Assyrians in 885 B.C. consisted of wood or leather soles, with a kind of counter attached to the back, leaving the instep and toes of the foot exposed. In A.D. 350 what was known as the Coptic low boot was in use. This consisted of a one-piece upper, decorated with an overlaid panel. The Coptic shoe of A.D. 450 had a tab on the back of the heel part of the upper, and a smaller tab at the toe end. The upper was made of brown leather, decorated with gilding and coloured embroidery.

*Later on we read that shoes in Edward II's period often measured 2½ ft. from heel to toe, the toe being fastened to the knee with a silver chain, and in Edward IV's period Parliament prohibited the use of footwear if the extension came more than 2 in. beyond the toe. From the year 1657 to the year 1716 the upper classes wore a type of clog and other classes a type of patten shoe.

During the reign of Charles II ladies' shoes with fabric uppers were made. These were hand-sewn and had high heels. For a long time afterwards the hand-sewn method

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* *The Romance of the Shoe* (Thomas Wright).

of making footwear was common, and even at the present time the craft is still practised to a limited extent.

In the year 1810 machinery was introduced for nailing the uppers on to the bottoms of army boots, and 37 years later wooden pegs were used as a bottom attachment.

Ten years later the sewing machine for stitching boot uppers was introduced, and two years afterwards, 1859, the Blake sewer, for attaching uppers to bottoms with a chain stitch. Up to this period most of the boots were made in the homes of the workpeople, and although a few factories were in existence, such factories were chiefly used for cutting the upper and bottom stock. With the advent of the Blake machine shoemakers began to enter the factories in larger numbers. In the year 1860 hand-riveting methods were adopted, and this was followed by the introduction of the riveting machine. Between the period covering 1868 to 1872 machines for imitating hand-sewn footwear were introduced for sewing turn shoes and making welted work. These were followed by the introduction of the screwing machine in 1876, and since that time the development of the boot and shoe industry has been rapid.

Craft. From the historical survey, it will have been noticed that the hand-sewn method of bootmaking was common for many years previous to the use of machinery. In those days the boot or shoe was made throughout by the shoemaker. Not only did he attach the uppers to the bottoms; he fashioned, cut, and closed his own uppers. Some time after the introduction of the sewing machine the two sections became gradually divorced; hence the hand-sewn shoemaker now purchases his uppers ready made.

Many modern methods of shoemaking are based upon the old craft ideas, and in many instances machinery strives to imitate the methods of the craftsman. For this reason we propose to give a brief outline of the hand-sewn method of making welted footwear.

Assuming suitable materials are to hand, the first important function is to prepare the various parts. For the time being the most important part under consideration is the insole. This is first mellowed by soaking in clean water and afterwards drying out so that the fibres of the leather retain moisture. In this condition the insole is fleshed and slightly hammered; afterwards the grain is buffed off to prevent cracking during wear, and, at the same time, degraining renders the leather more flexible. The craftsman next proceeds to block or mould the insole on to the last. This is done by straining over the last and tacking down, after which, when dry, it is rounded up to the shape of the last.

The next process is feathering the insole, which consists of cutting a rebate near the edge on the flesh side, and is necessary to provide a hollow for the upper and welt to bed into. The insole is next pierced with the awl according to the length of stitch required, after which the upper, ready prepared by the insertion of the stiffener and toe case, etc., is lasted into the rebate of the insole, the tacks used being afterwards withdrawn. Preparation of the welt, which consists of a narrow strip of leather, is next proceeded with. In order to obtain a tight seam it is necessary to bevel the welt along the edge, where it comes into contact with the upper; this allows the welt to fit close up to the upper and retain a horizontal position. The material used for sewing in the welt is made by taking a suitable number of strands of hemp until the required thickness is obtained; each strand is waxed separately, afterwards being twisted into one thread, and at each end a bristle is attached. Wax is necessary for several reasons; it binds the various strands together, reduces friction upon the thread and prevents the stitches slipping after formation. The welt is sewn in with the shoe held firmly between the knees. The awl, first entering the insole, passes through the upper and enters the welt at the edge of the bevel, the thread immediately following the withdrawal of the awl. This process is repeated, stitch by stitch, until the welt is completely and firmly attached to the upper and insole. Inseam trimming and welt beating are the next minor but important operations, and then the depression formed by the seam is filled with a suitable material having damp-proof qualities.

The old craftsman paid particular attention to the preparation of the sole. A piece of leather suitable for the purpose having been rounded out, it was soaked, mellowed, fleshed, and then well hammered, afterwards being temporarily fixed on the bottom. Similar methods are still employed. In this position the sole is rounded up to the welt, channelled, and then stitched on. Methods of making the seat and attaching the heel vary, and would have to be taken into consideration before fixing the sole; in any event, the heel is built up lift by lift and no useful purpose would be served in dealing with the subject at this stage. A comparison between the hand and machine processes described in later chapters may, however, be usefully made.

CHAPTER II

TYPES OF FEET AND LASTS

THE relation between the foot and the last is a matter which is receiving considerable attention at the present time. All feet are alike in structure but vary in different degrees in form and measurement. Whilst each nationality has its distinct characteristic, variations also occur in the national type. These variations are due, to a great extent, to the occupation of the people and the locality in which they live, and in a minor degree to their habits.

Generally speaking, the foot has some resemblance to its owner, a thin, bony person having a foot of the same character. In some countries, owing to inter-breeding of the population or other causes, the national characteristics are not so strongly developed.

The true Irish type of foot is large, square at the toes, and has a full instep; being broad, it requires a large fitting last. The predominant type in N. Ireland has many features resembling the Scotch foot, which is well arched, has a prominent inside joint and a large joint measure. The typical English foot is broad at the joints and instep, whilst the toes taper, and compared with the Irish they are not as long. The Welsh foot is relatively short with a prominent instep. To a certain extent the Spanish foot resembles the Welsh, although the toes are somewhat longer, and, on the other hand, the German foot is more like the Irish type.

Even in one country variations exist, the feet in certain localities showing a marked difference from those of a more distant locality. The typical foot of the South of England is different from that found in the north. In this instance the variation is mostly due to the occupation of the people. Until quite recently, most of the industrial undertakings of this country were to be found in the Midlands and northern counties, and the continuous standing in factories and workshops naturally had its effect upon the feet. The inhabitants of hilly districts likewise have feet of a different form from those living in a flat country, the former being relatively short in length, with a prominent instep and short heel measure.

The Last. The first essential to the manufacture of footwear is the last! A definition of a last is often given as "a wooden mould of the foot on which boots and shoes are made." This is not literally correct, although there should be some resemblance between the two. Many details have to be taken into consideration before a suitable last can be designed for a given purpose. The different forms of feet may be accommodated by having lasts of increased length and girth or *vice versa*. The purpose for which the footwear is required, the material to be used, and the method of manufacture, must necessarily have a great influence upon the form of the last. During wear, certain parts of footwear will stretch, whilst other parts will not stretch at all. Where the parts are likely to stretch in wear, the last must be less than the actual measurement of the foot, but where there is very little probability of stretching, the corresponding part of the last must allow for free expansion of the foot. Similarly, provision must be made for the substance and flexibility of the bottom. This is allowed for by increasing or decreasing the elevation of the toe of the last.

For the purpose of reference the chief features of a last may be classified as follows.

When the seat of the last is parallel with the ground, the elevation at that point is known as the "Pitch" (P). Pitch is given to accommodate the heel, and the height of heel required for a last would be measured by taking the amount of pitch plus the substance of the forepart of the sole. With the last in the same position, the elevation at the toe end is known as "Toe Spring" (T). This is varied according to the substance of the bottom. Lasts intended for rigid bottoms have more toe spring; those for flexible bottoms less toe spring. Toe spring also imparts clipping properties to footwear when used in relation to certain types, providing other things are equal. A line taken from P to the tread (X) would often show a certain amount of curvature in the waist of the last. This is referred to as "Waist Spring" (W). (Fig. 1.) Many lasts have too much waist spring; the ideal in this instance should be as near the shape of the bottom of the foot as possible. Excessive curvature in this part of the last causes shoes to gape along the sides and also increases the toe spring of footwear to an unnatural extent; it also has a detrimental effect upon the foot by interfering with the free circulation of the blood. We might digress here for a moment. Many makes of footwear are being manufactured with steel arch supports. Providing the waist of the last is similar to the foot, all well and good; otherwise much harm may result. Normal feet do not need arch supports; as a matter of fact, supports of any description should not be used except under medical advice. The chief points on the body of the last are referred to in the pattern-cutting section.

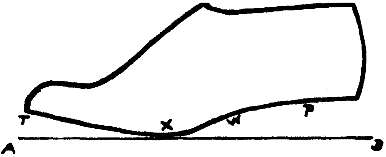


FIG. 1
POINTS OF A LAST

Types of Lasts. Different types of lasts are made to conform to the various conditions previously mentioned, and under no circumstances is it advisable to use them for purposes other than those intended. For instance, we have seen shoes, and even slippers, made on boot lasts, with deplorable results. It also follows as a natural corollary that the manufactured footwear should not be used for improper purposes. A dress shoe is not made to resist wet, neither is a slipper intended to be used for a country walk. We are quite aware that boys will play football in their lightest boots, boots totally unsuited for the purpose, and under such conditions it is unreasonable to blame the manufacturer for any defects that may arise.

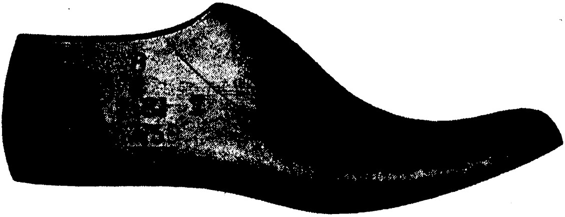


FIG. 2
HEAVY BOOT LAST

The type of last required for a gent's heavy boot (Fig. 2) will have the measurements larger than the foot, for obvious reasons; the waist should be at least three-quarters the width of the seat, and a large amount of toe spring will be necessary. For a lighter class of work both the width of the seat and the joint measurement should be less to allow for the stretch of the material, and as the sole will not be heavy, less toe spring will be required. (Fig. 3.)

The other extreme is a last intended for Court shoes, and here the fitting properties of the shoe depend upon the upper clipping the foot below the ankle. Lasts of this type are made thin along the sides; they have more back curve, are flat in the waist, have a reasonable amount of toe spring, and the dimensions are such as to allow for the stretching properties of the leather. (Fig. 4.)

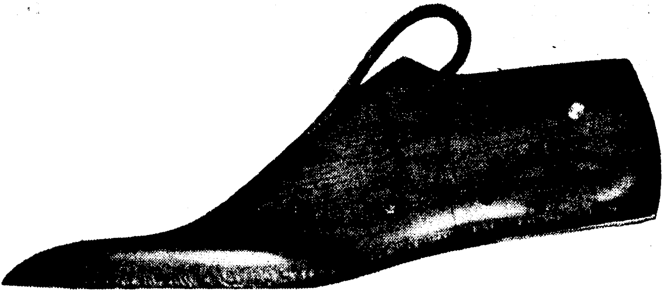


FIG. 3
LIGHT SHOE LAST

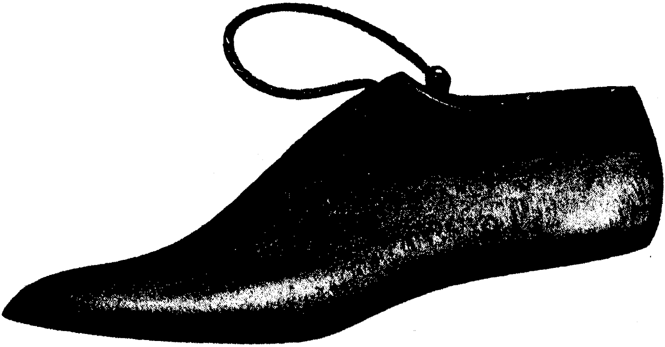


FIG. 4
COURT SHOE LAST

This type of last is intended to carry only a low heel; on the other hand, lasts for ladies' Court shoe work are usually designed to carry a high heel. The same general features would, however, be required, and although it would not be possible to make a flat waist, too much curvature in the waist should be avoided. When the foot is elevated by a 3 in. heel, the waist of the foot is relatively straight and not arched; at the same time a greater proportion of the weight of the body is transmitted to the forepart of the shoe, and consequently very little stress is applied to the waist portion, the conditions being altogether different from those which obtain where a low heel is used.

Lasts intended for slippers (Fig. 5) should be equal or even over the measurements of the foot in order to ensure comfort; the curvature at the back should not be so pronounced as in the case of the Court shoe last; there is very little or no pitch and no waist spring; toe spring should be generous and the sides full. A walking shoe last should contain features common to the boot last and the Court shoe last; the sides would not be as thin as the latter, but less than the former; the curvature of the back would be the average between the two, and the relation of the bottom would also vary between the two types.

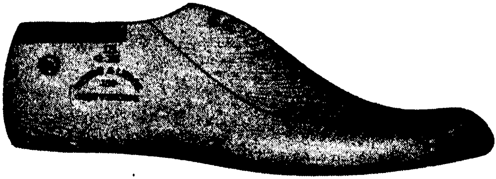


FIG. 5
SLIPPER LAST

Measurement of Lasts. The unit of measurement for the lengths of lasts is ⅓ in. The zero mark for English sizes commences at 4 in., and running up 3 sizes to the inch to size 13, recommences at size 1; thus a child's size 6 is 6 in. and a size 12 is 8 in. In the adult range a boy's size 2 is 9 in. and a man's or woman's size 5 is 10 in. The American unit of measurement is the same, but the zero point is $3\frac{11}{12}$ in. The French unit of measurement is the Paris point, three French sizes being equal to two centimetres. The notation of the latter commences at the beginning of the scale, and there is no break in the notation.

Some of the equivalent English and French sizes are as follows—

English child's size, 10—French size, 28
,, girl's ,, 1— ,, ,, 33
,, women's ,, 5— ,, ,, 38
,, men's ,, 8— ,, ,, 42

There is often a considerable difference between the actual last length and the *standard* last length. The *standard* length refers to the size which is marked on the last. Any extension beyond that has very little effect upon the fitting properties of the last; usually such extension is due to fashion or is used to give style to the last. The relation between the *standard* length of the last and the foot is important.

Footwear must be longer than the actual foot to allow for expansion in length, the average difference between the length of the foot and the standard last length being 2½ sizes when the measurement is taken with the weight of the body off the foot. We have referred in a later chapter to the "Pedograde" method of constructing insole shapes for lasts. By this method the size of the last is based upon the position of the inside joint measured from the back of the heel. In some cases this proves satisfactory, but last-makers, as a rule, take the extreme length to denominate the size, as, until recently, it has been very difficult to locate the exact position of the inside joint. Differences in the girths of lasts are made by what are known as fittings. Men's and women's sizes will average $\frac{1}{4}$ in. in girth between sizes and $\frac{1}{4}$ in. between fittings, whereas in the girls' and children's ranges the difference is usually $\frac{3}{16}$ in. between size and size and fitting. In America the fittings are described by letters, and in this country both letters and numbers are used to denote the fitting. In the American scale, A = 0 fitting, B = 1 fitting, C = 2 fitting, D = 3 fitting, E = 4 fitting, EE = 5 fitting.

For British fittings, Messrs. Mobbs & Lewis, Ltd., the well-known last-makers, use the following for medium grade shoes—

A	equals	1	fitting	D	equals	4	fitting
B	,,	2	,,	E	,,	5	,,
C	,,	3	,,	EE	,,	6	,,

The same firm also utilize another scale for X fitting lasts, where greater joint width is required with normal heel and instep fitting.

In this instance—

1x	fitting is	2	fitting	joint with	1	fitting	instep and	heel.
2x	,,	3	,,	,,	2	,,	,,	,,
3x	,,	4	,,	,,	3	,,	,,	,,
4x	,,	5	,,	,,	4	,,	,,	,,

Where numbers are used to denote the fitting, numbers 1 to 7 are usually employed.

CHAPTER III

CLASSIFICATION AND MEASUREMENT OF FEET AND LASTS

ONE of the most difficult problems the industry has had to contend with is the system, or want of system, in classifying and measuring feet and lasts. Feet were often classed as being slim, long, average, or full, and although each type had distinct features in plan and profile, the description did not convey a very adequate idea of the essential differences between the types. We have seen that the various types of feet are accommodated by increased or decreased fittings in the last; the slim foot would have a small fitting last and the full foot a large fitting last. We also know that it is usual to make a difference between the fittings of $\frac{1}{4}$ in. or $\frac{3}{16}$ in. as the case may be, but why and how this fraction was arrived at no one seems to know, except that it was a general custom, no doubt determined by the law of averages. Then take the methods used in measuring feet. It is usual to take the ball or joint, waist, and instep measures in addition to others. Many systems or methods are adopted, and yet it has not been possible to say exactly where the position for taking the ball measurement and instep measurement should be located. Applied to lasts, the difficulty is increased on account of the necessary variations which must be made between the foot and the last. One method adopted to locate the joint and instep positions on the last is based upon taking a straight line from the top of the puff up the front of the last, equal to one-third of the standard last length, the instep position being located by taking a line in the same direction and from the same position, equal to one-half the standard length of the last. With this method, the question immediately arises: Where is the top of the puff? The answer may be: At the highest point on the top of the toe; but as this position is arbitrary it is evident that accurate locations cannot be obtained. We have used the foregoing examples merely to emphasize the necessity for a more scientific specification of feet and lasts. Fortunately, the need has been realized. Mr. H. Bradley, D.I.C., A.R.C.S., B.Sc., director of the British Boot, Shoe and Allied Trades' Research Association, has been making a close study of the matter for some considerable time, and has evolved a method and invented suitable apparatus for dealing with the subject in a scientific manner. As a result of research, and following different lines, Mr. F. W. Roberts, F.B.S.I., of the Leicester Technical College, has produced other forms of apparatus known as the "Datum" foot and last measuring machines, more as an aid to research, although at the same time much useful and practical classification and measurement may be obtained. We have not the space to deal fully with either, for the subject is too bewildering, but as we consider it will be interesting, a brief outline will not be out of place.

Research Association's Foot and Last Measuring Instrument. No adequate idea of the Research Association's foot measuring instrument can be given without prefacing its description with some account of the underlying idea, or purpose of the research, also the discoveries and progress that have attended the investigations. These discoveries are the principles on which the measuring instrument operates.

Put in its briefest form we may say that the idea, or purpose of the work, is to find a method of measuring a foot which is at one and the same time easy to carry out

—not involving a large number of settings and observations—and yet comprehensive in the measuring of its results. The measurements made must be few in number so that they are quickly and easily obtained, and still they must be as nearly as possible a complete specification of the foot as regards type, shape, size, and conformation. The ideal is, therefore, ambitious. But it is also most laudable, for obviously if the goal can be reached, or even only partly attained, the result will be of immense importance to footwear manufacturers. If it becomes possible to measure one foot so that its type, shape, etc., are completely specified by a series of two or three numbers, a collection of such measurements over groups of feet can be analysed and condensed to a specification of the whole group. At last we have a meaning attached to such a phrase as "the average foot." This research gives the average, and more than that—it gives the proportion of feet at the average and the proportions of other types and conformations. Such group specification is essential to the satisfactory mass production of shoes for all possible markets at home and abroad.

The research must, quite naturally, begin with the study of feet themselves. It soon became apparent that important characteristics of feet are related by a systematic geometry, as it were, a foot scaffolding.

On a foot plan we can draw lines AB and DC which touch the plan at the inside joint-heel, the outside joint-heel. These two lines produced backwards intersect at the point F, and include an angle between them which we call the focal angle and symbolize θ (Theta). The lines AD, BC, which touch the toe and heel respectively, are both at right angles to the inside line ABF. Suppose that when the foot plan was drawn care had been taken to mark the position of the small bone projection at the root of the fifth metatarsal—a bonal prominence that is easily located on the outside waist of the foot—the point G in the diagram. Draw lines from G to A and from G to B. One way of expressing a remarkable discovery made in the course of the research is by saying that on all healthy feet, that is, of course, feet not obviously deformed, the angle at G between lines GB, GF is equal to the angle at A between the lines AG, ABF. This angle we call the fitting angle and symbolize it ϕ.

The next point of importance is this: the bisector of the focal angle cuts the two lines GB and GA, and determines for us the position of the two intersecting points O and P. A line through O, drawn at right angles to the focal angle bisector—the line VW—marks the widest part of the heel. A line through P inclined to the focal angle bisector at angle equal to a right angle, less the focal angle $(90° - \theta)$—the line TU—marks the ball line.

Finally if the side elevation of the foot is superimposed on the plan in such a way as to make the line AF coincide with the ground line, the instep hangs along the line AG, as well as a line that is not exactly straight can lie along a straight line.

This is a brief description of the foot geometry, or scaffolding, as we have called it. It is readily seen that the whole scaffolding can be drawn out if we know three things, namely, (1) the length of the line AB, i.e. the length of the foot (S), (2) the value of the focal, or type angle θ, (3) the value of the fitting angle ϕ. In other words, S, θ, ϕ are sufficient to specify the scaffolding of a foot, and when a scaffolding has been drawn out, it is easy to go a step farther and draw a close estimate of both the plan of the foot and the side view. These numbers are comprehensive in their meaning. Analysis of collections of these three measures from large numbers of feet yield results of profound significance. (Fig. 6.)

The Research Association's measuring instrument is designed to measure conveniently, easily, and, therefore, rapidly, the values of S, θ, ϕ. It measures the length of the foot and two angles. It has a stout plate of glass on which the foot is placed. Bars run along the edges of the plate and the foot is put on in such a way that its inside joint and heel touch the bar running along one long side of the plate. This bar is the embodiment of the line AB. The toe touches the bar at the end of the plate which represents the embodiment of AD. Another movable bar slides on the plate and is set to touch the foot at the outside joint and heel. This bar is the embodiment of the line DC, and it is connected by a linkage to a bar underneath the glass plate pivoted at one end. This bar is so linked with the slidable bar on the top of the glass plate that the two bars are always parallel. The pivoted bar underneath the glass indicates on angle graduations engraved on the plate, and because it is always parallel to the sliding bar on top of the plate it indicates the focal angle θ. It ought to be said that underneath the glass plate are electric lamps, throwing up the shadows of the bars beneath the plate to show very clearly against the angle graduations.

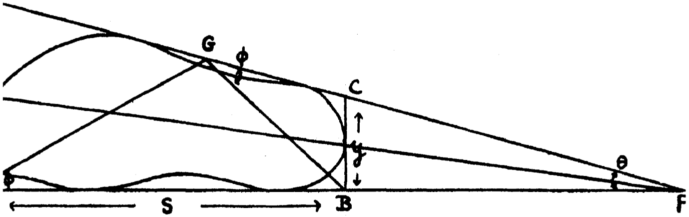


FIG. 6
FOOT GEOMETRY

Also on the movable bar which comes to the outside of the foot there is a sliding notch which is set adjacent to the metatarsal bone projection on the outside waist of the foot. Setting this notch operates another bar underneath the glass plate, which indicates the fitting angle ϕ on the scale engraved on the glass plate.

The scale for measuring the length of the foot is on the inside bar, against which the foot is placed to touch at the joint and heel. A moving bar brought up to the heel gives the indication on the size scale.

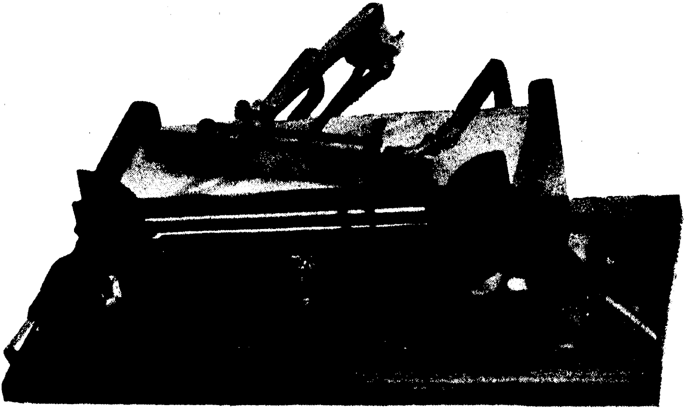


FIG. 7

RESEARCH ASSOCIATION'S FOOT AND LAST MEASURING MACHINE

Thus the instrument measures on the foot the three fundamental items, S, θ, ϕ; in words: size, type, and fitting. Furthermore, it should be said that it will measure both left and right feet, i.e. it is completely symmetrical, operated by the release or fastening of two catches, which need not be described in detail here. (Fig. 7.)

Having shown that important characteristics of feet are related by a geometry, or scaffolding, as we have called it, we reasonably conclude that corresponding characteristics of lasts ought also to be inter-related in the same way. This forms the basis of a system of last measurement and criticism. But to go fully into this matter of last measurement is a long process replete with technicalities which would be out of place here.

Summarizing, we may say—

1. The research first made discoveries regarding the geometrical arrangement of foot characteristics.

2. The next step was to devise an instrument to measure feet according to these discoveries and to determine the values of the three items—size and two angles—which are sufficient to specify the scaffolding for the foot.

3. Then comes the measurement of large numbers of feet. This statistical research is still proceeding.

4. The research has opened up a system of measuring and criticizing lasts so that they can be judged as regards their shapes, types, or forms. They can also be specified in the same way by the same three items, S, θ, ϕ as feet.

The S, θ, ϕ for any last are the values of these three things of feet which are suited by shoes off that last.

5. This opens up a shoe shop fitting system when shoes come to be marked with their appropriate values of S, θ, ϕ, in place of the usual size and fitting as now done.

The "Datum" Foot and Last Measuring Machines. An essential preliminary to measuring any foot or last is to settle upon some definite position which will be constant under all circumstances. The principle utilized in the "Datum" machines is with the foot or last vertical around an axis which corresponds with that around which a last is turned in the Gilman lathe. The centre line coincides with the line found by bisecting the angle

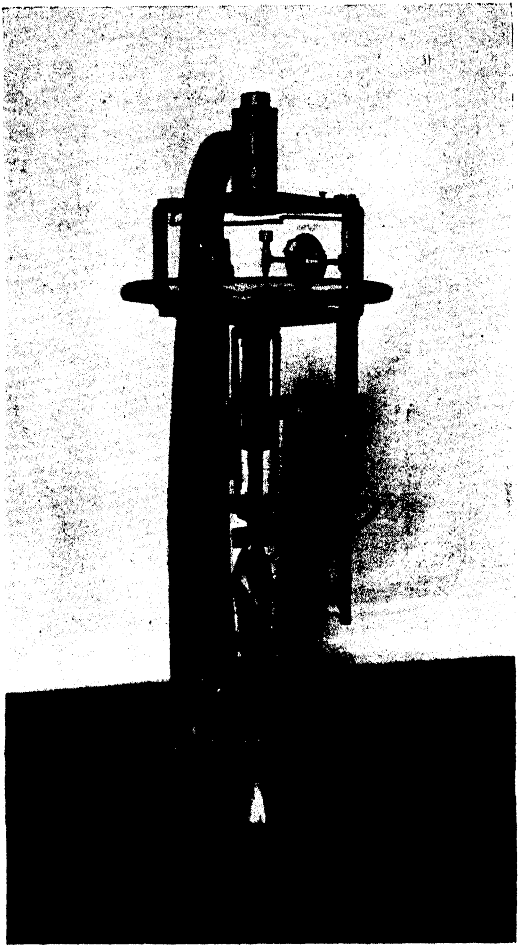


FIG. 8

"DATUM" FOOT AND LAST MEASURING MACHINE

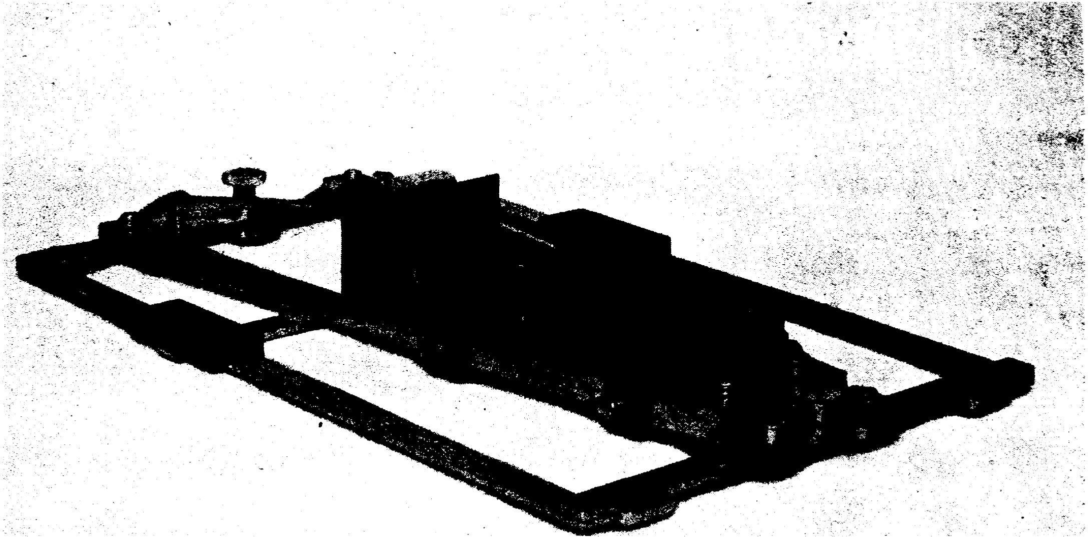


FIG. 9

DATUM 'OO' AND LAST MEASURING INSTRUMENT formed by the two converging lines in the previous illustration. After setting the foot or last in position, and without further movement, the following information is read off—

1. The length in four dimensions, viz. size, inches, Paris points, and metric measures.
2. Distances from the back of the heel to the heel seat line and joints (four points).
3. The twist of the forepart, showing the position of the big toe from the centre line.
4. The centre of the last or foot, showing the balance of the two sides and whether the curves are matched for the fit of stiffeners, etc.
5. The spring of the toe.
6. The "spread" and "type." These are new features which may replace the girth or fitting. "Type" is a figure which will classify "spread," irrespective of the size, so that by a single figure it is possible to indicate the general conformation of any foot or last.
7. The circumference at any point along its length, measured from the back of the heel.
8. A pencil graph of any section as above and with the cross axis showing parts in each quarter section.
9. Areas of the graphs. (Fig. 8.)

This machine will measure any foot or any last, giving every possible measure necessary to reconstruct it, and every dimension is accurate and strictly comparable in every case. The second machine, more suitable for use in retail shops and other establishments of a similar nature, will give all the items from 1 to 6 and enable a quick choice to be made of the type of shoe required for a particular foot. In all cases the results are absolutely independent of the personal skill of the operator. (Fig. 9.)

CHAPTER IV

PATTERN DESIGNING AND MAKING

No department of the modern factory is of more importance than the pattern-room. The productions of individual firms are often identified by the design imparted by the pattern-cutter, and although machinery is used for reproducing and reducing or enlarging the various parts found in the many styles of design, original designs must be the product of hand and brain.

In latter years, scientific application, coupled with artistic ability of no mean order, have been the requirements of the chief architect of the modern factory. It is here the conception of most of the details present in boots or shoes should take place; the designer must not only have the ability to create, but he must have a good practical knowledge of all the chief operations in every department. In many of the smaller factories this work is delegated to the foreman clicker or to the manager, presumably to save expense. That it is a short-sighted policy many never seem to realize. In large concerns, the pattern-cutter spends his whole time creating new designs, many of which never appear on the market, yet the time and money is well spent and returns a good interest. It must be evident that when the designer has to act in a dual capacity there is not much time left to use inventive ability. The best he can do, and what most often occurs, is to copy a design made by one of the large firms, with the intention of having exactly the same article. The same style of work can never be produced under such conditions, chiefly because individuality and detail expressed by the original designer is lacking.

For convenience of description, pattern-making may be broadly divided into the following sections: (1) Standard construction; (2) designing, or cutting the sectional parts; (3) grading, or scaling the parts into various sizes; (4) preparation for use in the factory.

Divisions (1) and (2) may again be classified under different headings, viz.—

(1) Those which cover the toes and sides of the foot, as Court shoes, slippers, etc.

(2) Those which cover the instep, as walking shoes.

(3) Those which terminate just above the ankle, as boots.

(4) Those which cover the leg, as field boots, etc.

The production of a standard or outline form of the upper is the first essential, and although in experienced hands it is possible to produce a standard direct to the last, better and more satisfactory work is obtained by first cutting a forme, or last shape.

An examination of any modern last will show that both sides are not alike, for if divided exactly through the centre, the outside portion would be wider than the inside, and the length of the outer section would, on the average, be less than the inside. Therefore, it is advisable to produce a forme to each side of the last.

Many methods of forme-cutting are recommended, all striving to obtain the same result, i.e. to produce a shape which, when transferred from the curved surface of a last on to a flat surface, will secure the desired fit. With some methods this is impossible because no consideration is given to the alteration of form caused by placing the paper shape on a different plane.

Forme-Cutting. Having selected a suitable last, first mark a straight line up the front, taking the centre of the toe and top of the comb as the terminal points; then repeat the same process down the back by drawing a line from the centre of the seat to the top. If the last has a plated bottom, so much the better; if not, it will be necessary to mark an outline of the insole in the waist. Now place the outside part of the last on a piece of paper, mark the outline and cut out about one inch larger.

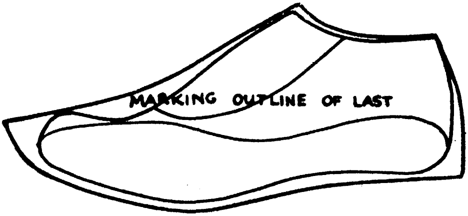


FIG. 10

(Fig. 10.) When convenient, it is advisable to mould the paper to the last without the use of mitres or cuts. As, however, modern lasts have a considerable amount of depression across the joints, and at other points, the paper will not easily bed down to the wood, and it will become necessary to make a few cuts across the marked outline at places coinciding with the greatest amount of projection.

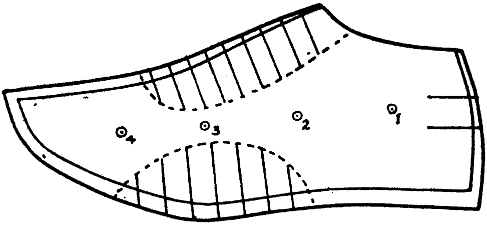


FIG. 11

The direction in which the cuts are taken is important; they should always be perpendicular to the outline. The paper may now be fixed or held on to the last, when it is turned down to marks already made on the last, carefully moulding as the folding over proceeds. Along the bottom edge, rubbing over may be resorted to, when the outline will be distinctly seen. (Fig. 11.)

The paper is now removed and cut out to the folded or marked edge. An inside forme is next produced in exactly the same manner.

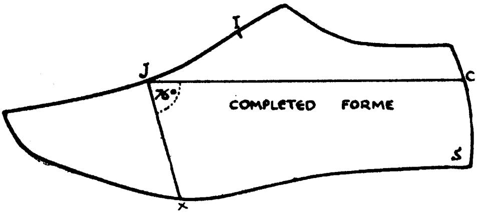


FIG. 12

We now mark the outside forme on a sheet of paper and place the inside over it, so that the toes and top of comb coincide; the working forme is completed by averaging the difference up the front and down the back, cutting to the larger side along the bottom.

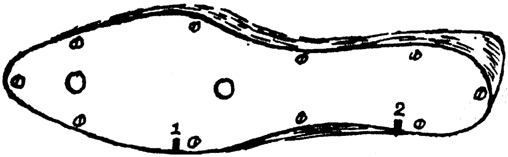


FIG. 13

(The completed forme is shown in Fig. 12.)

Another method of forme-cutting introduced by Mr. G. L. Miller, A.B.S.I., might be of interest. The last is marked up with a straight line up the front and down the back, with the usual waist curves if required. Location points are then marked on the bottom of the last at the seat and at the joint (Fig. 13), also down the back of the last (Fig. 14), up the front of the instep, and

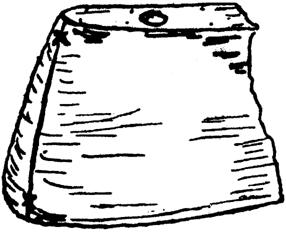


FIG. 14

at the highest point of the toe (Fig. 15). The last is then placed on a sheet of paper and not moved until all the

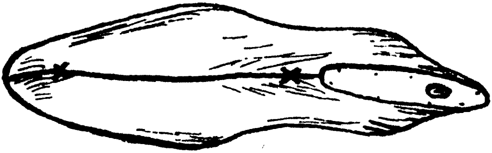


FIG. 15

location points are reproduced. First mark along the waist to the corner of the seat, and reproduce points as

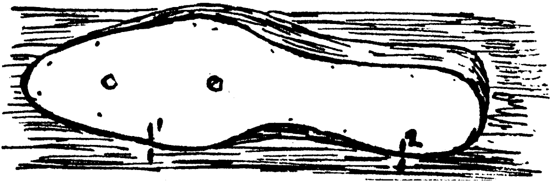


FIG. 16

in Fig. 16; then continue from the seat point to the back with a straight line. Then place the pencil under the paper at the back and bring the paper up to the last, reproducing the points at the seat and counter. Next lift the paper up to the forepart of the last and mark from toe to joint. With the paper in this position, place the pencil under the toe end of the last and mark the location point, afterwards repeating the same process at the instep. The main points for the production of the forme are now produced as in Fig. 17. Connect the points at the back by a curve of 12 in. radius for men's lasts and 6 in. radius for women's lasts. The points up the front are also connected by curves of the same radius, and it is claimed that these curves will be suitable for normal lasts. The forme is now cut to the lines made, leaving a small proportion at the toe end. Now place the forme on the last and make the necessary adjustment for the length by wiping the paper over at the toe end. If necessary, the forme may now be slotted and final adjustments made if required.

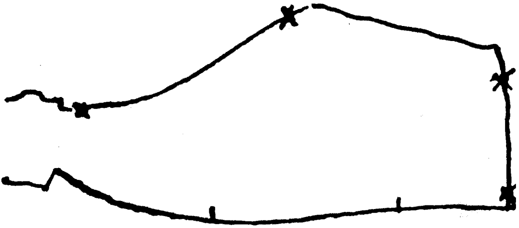


FIG. 17

Many other methods of forme-cutting may be employed, some mechanical, others more scientific; as, however, a description would involve much technical explanation, we must reluctantly proceed to the next stage.

Standard Construction. It is our intention to deal as briefly as possible with the construction and design of some of the styles previously mentioned. Many systems of standard construction are advocated by various experts; each has the same object in view, and some produce almost identical results. The best method to adopt, however, is one that would give the same result time after time, when working to the same forme and measurements; practical adaptability must also be a strong feature in the selection of any method.

Bearing the foregoing remarks in mind, we make no apology for selecting the methods introduced by Mr. R. H. Brookes, F.B.S.I., Superintendent of Boot and Shoe Instruction for the County of Northampton; they have the advantage of being scientific and practical, and may be used with success for all classes of work.

The foundation of the standard or outline form of upper for styles covering the toes and sides of the foot is the whole cut Court shoe.

The chief points to be determined are (1) the shape and character of opening for the foot, (2) the means to prevent slipping about in wear.

The height of the front should come just above the bend of the foot, over the joint or tread; the height of the back should cover the curve of the heel bone, but below the bend caused by raising the heel; while the shape of the opening must be as high at the sides as possible, consistent with room for free movement of the muscle situated over the instep portion of the foot.

For the novice, certain lines and points based upon proportions of the foot or last may be used as an aid to construction. (See table.) To obtain a good fit, the first essential is a properly shaped last. Having obtained this, cut the forme and mark on the positions of counter and joint points, as C.J. (Fig. 12.)

For this style, the standard pattern may be cut from folded paper, and by adding (before cutting out) any necessary allowances for closing, lasting, etc., it becomes the working pattern for the outsides. The upper must be "drafted" to secure a tension round the edge of opening; to obtain this, the top line must be shortened.

Method. Place the forme on the folded paper, the toe end level with the folded edge and overlapping $\frac{1}{8}$ in. at J. Mark round the bottom edge of the forme from toe to seat and down the back; prick through on to the paper positions of C and J, and add the necessary lasting allowance, according to the character of the material and thickness of sole (for turn-shoes). (Fig. 18.)

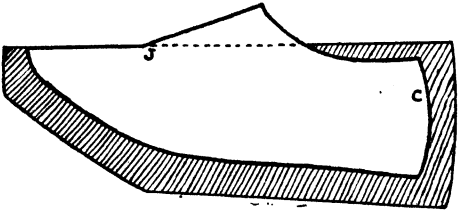


FIG. 18

Remove the forme and from point C measure towards the folded edge an amount equal to one-twentieth of the standard last length as C B. From J measure along folded edge one-twelfth last length as J X, and the same distance down from X as X Y. Join Y B and design curve from J to Y. (The distance from J to X and X to Y is for firm leathers or fabrics; for very soft and stretchy leathers it may be made one-fifteenth of the last length.) Further drafting or shortening of the top line is usually needed and is accomplished by taking off a portion at the back; for fabrics and firm leathers $\frac{1}{8}$ in. at the top to nothing at the bottom is quite sufficient; for soft and elastic leathers $\frac{1}{16}$ in. to $\frac{1}{8}$ in. more is to be taken off all down the back. (Fig. 19.)

As previously stated, this is practically the foundation of all Court shoe patterns and the different styles are evolved from this by dividing into sections of different shapes, or adding small tabs at the front, etc.

For Albert and Grecian slippers, which come a little higher up the front, an important point to observe is that there must be room for the foot to pass in comfortably; the distance between the top of back and the top of front tab must not be less than the long heel measure of the pattern, which is the distance from the instep to the seat. (Fig. 20.) The front must not come more than half the distance between joint and instep, or one-eighth of the last length above J, whereas in the Grecian slipper the back should not extend above the counter point, C.

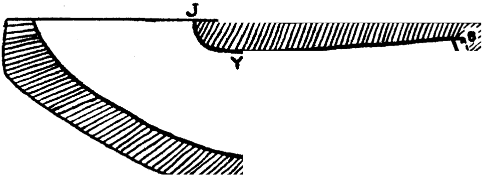


FIG. 19

ALBERT SLIPPER

FIG. 20

Shoe Patterns. In cutting shoe standards from a forme cut to the last, the first points of consideration are: (1) Height of back, (2) height of front, (3) shape of ankle curve. At the back, they should be the same as in the case of Court shoes, i.e. one-twentieth of the standard last length above the counter point; at the front, height varies with style and fashion, from a little above the instep point to 1 in. above the joint position. In order to prevent cutting the foot by action of movement at the ankle, the shoe should not extend more than one-twentieth of the last length above the instep point.

Construction. Mark outline of the forme, transferring points C, J, I, X. Mark T at one-twentieth of the standard last length from I and C respectively. From I draw a line parallel to J X and divide into five equal parts. Join 2 T and from T measure off one-fourth of the standard last length as T A. Cut the curve from T to T, passing through or below point A. Lasting over allowances are then added, as well as some allowance for the stiffener, if required. (Fig. 21.)

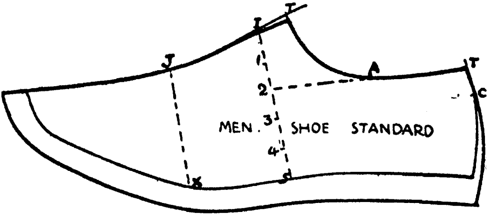


FIG. 21

The consideration of lasting and other allowances will be found later in the chapter. (See Index.)

Boot Patterns. The construction of a boot standard demands more theoretical explanation. Most important is the relation between the leg and the foot; this includes leg-position (in relation to the length of the foot), and leg-direction (in relation to the ground or level surface). The former is termed "pitch," and the latter the "inclination" of the pattern.

Both are affected by the position and movement of the ankle joint, and in the method to be described, the Point P (pitch point) is considered to represent this position.

The required pitch and inclination may vary under different conditions, such as the position of the upper at the seat when pulled over at the toe end and the substance and character of the material used for uppers. The position as described is for uppers pulled over with the "seats level" with the seat of the last, and for light medium material.

(*a*) For "seats up," or stiff leather, the point P is brought forward 1/16 in.; and for (*b*) "hoisted" uppers, or if cut from soft, stretchy leathers, the point is taken 1/16 in. backward from the normal position; if both conditions of (*a*) or (*b*) occur together, as they very often do, the point is brought ⅛ in. forward or backward, as the case may be.

Application. On a sheet of paper mark the outline of the forme, transferring points S, C, J, I, X. (Fig. 12.) Join X S, and draw I P parallel to X S and equal to one-half of I S. From S make S B equal to the pitch of the

TABLE OF POINTS USED IN STANDARD CONSTRUCTION

Point.	*Measured from.*	*Proportion of last length.*	*Distance for size 5.*	*Difference between sizes.*
Counter (C)	Seat	⅛	2"	1/16" (1/18")
Joint (J)	Counter	¾ for E fitting	7½"	¼"
Instep (I)	Joint	¼	2½"	1/12"
Contact (X)	Joint	(at angle of 76	° to joint line)	
Pitch (P)	Instep	(parallel heel (I	to line XS and S)	½ long
Ankle (A)	Pitch	3/20	1½"	1/20"
Height of Shoe Front (F)	Instep	1/20	½"	1/60"
Height of Shoe Back (T)	Counter	1/20	½"	1/60"
Centre of Ankle Curve (K)	Top of back	¼	2½"	1/12"

last and join B X. From P draw P A perpendicular to B X and equal to three-twentieths of the standard last length.

*Draw A^1 A^2 through A at the required angle, making A A^1 and A A^2 equal to one-third of I S minus one-eighth of S B. Draw A L perpendicular to A^1 A^2 and equal to A P (or according to the desired height). Draw L L^1 and L L^2 parallel to A^1 A^2, making L L^1 and L L^2 equal to A A^1 plus ⅛ in. (or according to the required width). Join A^2 and I and bisect in H, join H S and make S H equal to S I minus one-eighth of S B. Mark in throat curve from A^2 through H to I, and back curve from A^1 to C. Lasting over allowances are then added as well as some allowance for the stiffener, if required. (Fig. 22.)

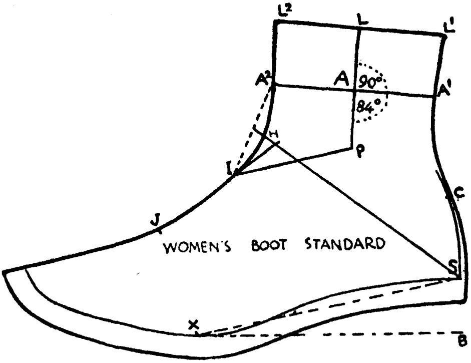


FIG. 22

All proportions given in the table are based on "standard" last lengths, i.e. the length of the size in

---

* The angle made by this line to the perpendicular line from the pitch point (P), varies with the pitch of the last. For ⅛ in. pitch make an angle of 80°, and for each ¼ in. of extra pitch add 1° to the angle; also for men's and boy's work make A L equal to one twentieth of the standard last length, instead of three-twentieths.

inches as marked on the tape or size-stick, zero being at 4 in.

Note. In using this method for all kinds of lasts, men's, women's, and children's, some variation in the length of the joint line C J is necessary for different fittings. The measurements given in the table are for Fitting E, based upon size 5, with a joint girth of 8½ in., and a difference between size and size of ¼ in.

For example, we will assume the sizes had a joint girth as follows—

Size	6	7	8	9	10	11	12	13	1	2	3	4	5	6	7	8	9	10	11
Joint Girth	5	5¼	5½	5¾	6	6¼	6½	6¾	7	7¾	8	8¼	8½	8¾	9	9¼	9½	9¾	10

When the joint girth for any size measures more or less than the above, make the line C J longer or shorter respectively by 1/16 in. for each ¼ in. difference.

We have referred to lasts in the previous chapter, and where a new shape or design of last is wanted, the designer is required to construct the insole shape. Many methods may be used for this purpose, but a method based on the principles of the Pedograde system of measuring is most likely to produce an efficient sole shape. The principles which must be taken into consideration are—

1. The position and direction of the tread should be the same on the last as on the foot.
2. The size should be determined by the position of the tread, i.e. the distance from the back of the heel.
3. Provision should be made for variation in the length of the toes, e.g. long, medium, or short toes.
4. Provision should be made for variation in the direction of the toes.
5. The sole shape should extend beyond the toe end of the foot.
6. The width of tread should be calculated in relation to the girth of the joint.

Method of Application. Draw a vertical line A B 7 in. for Size 8 adults. For other sizes, increase or decrease the amount by $\frac{}{8}$ in. Draw C D (tread line) at an angle of 100° to A B on the inside of the sole shape. For a medium width of tread, make C D equal to $\frac{1}{8}$ of the joint girth plus $\frac{3}{12}$ in. for men's or $\frac{2}{12}$ in. for women's. Make B E equal to $\frac{1}{2}$ A B and mark point F $\frac{1}{2}$ in. beyond E (this is for medium length of toes); make B E $\frac{1}{4}$ in. longer for long toes or $\frac{1}{4}$ in. shorter for short toes. The angle E B C may be varied for different styles; 80° would give a straight form, 76° to 72° a medium form, and 68° a twisted form. A G equals $\frac{1}{4}$ A B; H H (heel line) should

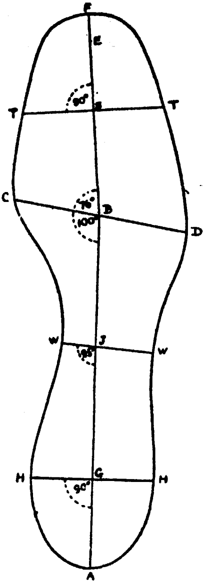


FIG. 23

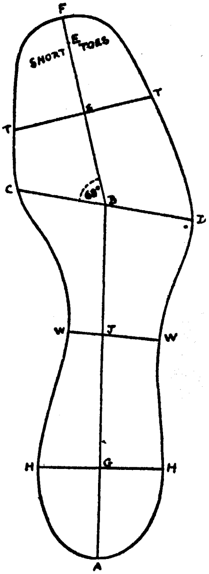


FIG. 24

SOLE SHAPES

be at right angles to A B and $\frac{3}{4}$ of C D less $\frac{1}{8}$ in., equally divided each side of G. G J equals $\frac{1}{2}$ G B; W W (waist line) at 95° to G B on the inside. W W equals $\frac{3}{4}$ of H H, placing $\frac{1}{3}$ of this on the inside and $\frac{2}{3}$ on the outside. For a medium width of toe, make E S equal $\frac{2}{5}$ of E B and S T on each side equal to S E. T T (toe line) at right angles to F B. Draw curves through the points found. The heel curve H A H may be in the form of an ellipse, and the toe curve T F T may be made alike on both sides of S F, but this is not essential. (Figs. 23 and 24.)

Designing. Although the designing of a boot or shoe should refer to the completed article—material to be used, method of making, and the last on which it is to be made—it is more usual to apply the term "design" to the division of the standard into various sections comprising the upper.

The different styles common to the trade are known by recognized names; either those of certain people, as Derby, Lorne, Spencer, Blucher, etc.; or of places, as Oxford, Balmoral, etc.; or by terms describing their character, as Laced, Button, Strap or Bar, Gussett, Open-tab, Whole, Three-quarter or Half Golosh.

The simplest division is to design the standard into two parts, such as a vamp and quarter or a golosh and leg; the vamp and golosh may be further divided by a toe-cap.

Although the exact shape of many of these sections may be largely a matter of taste, and an experienced "designer" may be guided by his experience and artistic ability, beginners can be helped by making use of certain guide points, based upon recognized principles and proportions.

For example, the length of a vamp or golosh is a consideration involving appearance, comfort, and economy of labour and material; but a kind of average of all these is obtained by fixing the depth at the position of the joint point J, as marked on the standard, leaving the expert to move above or below this point for special conditions. Fashion plays an important part in deciding the location of the point, as also does the type of last and upper.

A work of this size will not admit of entering into all the reasons for selecting the particular points referred to, although some of the simpler sectional forms will be described.

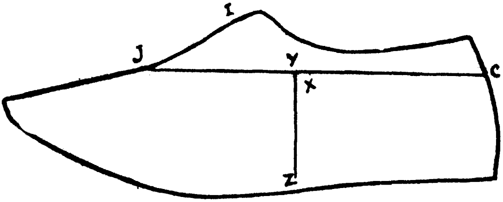


FIG. 25

Circular or Oxford Vamp. On the standard pattern bisect the joint line C J in X and from X take a point Y $\frac{1}{4}$ in. forward. From Y draw a line perpendicular to C J to edge of forme, as Y Z. (Fig. 25.)

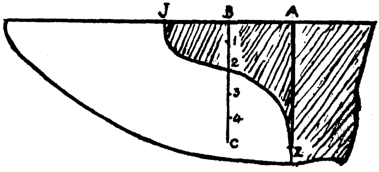


FIG. 26

Cut a piece of paper large enough for the vamp pattern; fold, and place under the standard, with the folded edge $\frac{1}{16}$ in. below the point J, but level at the toe end. Cut round the bottom edge from toe to waist, prick through at Z and below J. Now remove the standard and on the folded paper draw a line from Z at right angles to the folded edge, as Z A. Bisect A J in B; from B draw B C perpendicular to fold, and reaching to edge of forme. Divide B C into five equal parts and design the vamp curve from J, passing through division 2 and Z to the edge of the paper. (Fig. 26.)

Straight Golosh. On the contact line (J X at 76° to C J already marked on boot standard), measure two-fifths from J and draw a straight line to counter point C. (For narrow lasts, take one-third from J instead of two-fifths.) Join by curve from J meeting the line C. For the side seams of three-quarter or half golosh, measure half the last length from C, as C D, and draw a line at 80° from D. (Fig. 27.)

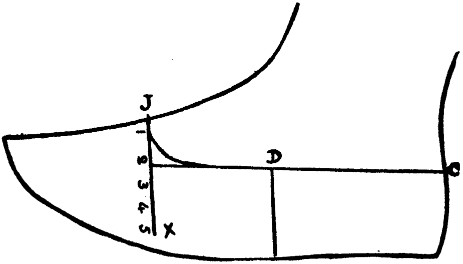


FIG. 27

Straight Toe-cap. Take the vamp pattern and mark off the lasting allowance from toe end as L. Divide J L into three equal parts and give one part to the vamp and two to the cap. Make the front edge of the cap the arc of a circle; for men's work a radius of 14 in., and for women's a radius of 10 in. is suitable. Cut these out flat, then fold paper carefully, and place under the vamp pattern with the cut edge level with the point 2. (Fig. 28.)

Derby Quarter. Take two-fifths of the contact line from J as before, and find point 2 for end of tab, as for circular vamp. Join point 2 to Y by a straight line, and bisect Y Z and Y 2. In designing the curve care must be taken not to pass beyond the bisecting points on Y Z and 2 Y.

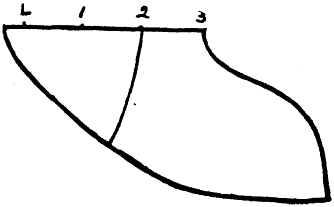


FIG. 28

From 2, measure ⅛ in. towards Y and draw a line from the point thus found to J, to ensure the front of tab being straight across the boot. The corner at J may be left square or rounded off. This gives a vamp curve suitable for light work; for heavy work curves similar to the dotted lines are used. (Fig. 29.)

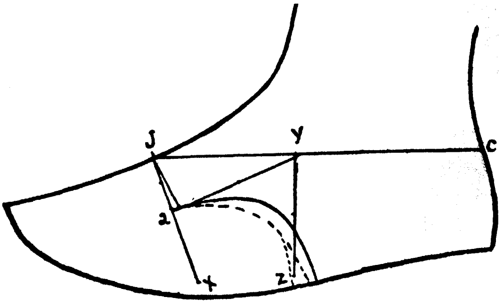


FIG. 29

Similar lines may be used for the production of a "high wing" circular vamp.

Derby Vamp. It is a good plan to design the Derby on a copy of the standard and cut it into the two sections; then for the vamp pattern, take the front section and place on folded paper, add from $\frac{7}{8}$ in. to 1 in. from J to H, and $\frac{3}{8}$ in. for underlay. (Fig. 30.)

Derby Toe-cap. During the process of lasting, it is found that the vamp, which is under the tab of the quarter as J H, is drawn forward at least $\frac{1}{8}$ in., thereby causing the front of the cap to lose some of its curvature. To counteract this, increase the curvature by reducing the radius to 10 in. for men's and 6 in. for women's work, and bring the front edge of the cap at the centre $\frac{1}{8}$ in. higher from toe end.

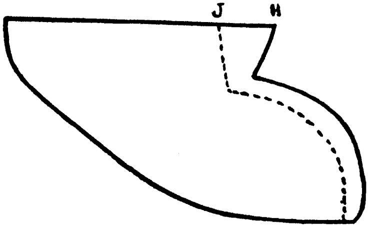


FIG. 30

The styles described would apply equally to boots or shoes; they simply represent the design without any allowances for seams, underlay, methods of closing, or different edges used in closing.

Stiffener Allowances. Lasting and stiffener allowances have been referred to. It is better to add these to the standard before cutting the sectional parts. An allowance for the stiffener consists in leaving a certain amount on the pattern from counter point to seat, in order that provision may be made for the insertion of extra substance between the lining and the outside.

The addition will depend upon the substance, the nature of the upper material, and the substance of the stiffener. Uppers of light, stretchy material will give more under the strain of lasting, and readily adapt themselves to the increased bulk round the seat when the stiffener is inserted; stout, heavy leathers will not; hence the allowance must be greater for the latter kind of material. As a rule, from $\frac{3}{32}$ in. to $\frac{3}{16}$ in. will be found sufficient; the amount required is graduated from the counter point to the full allowance at the seat. Under certain conditions no allowance is required.

Lasting Allowances. Lasting over allowance is represented by an amount beyond the bottom outline of the forme, and will vary according to the method of making, substance of the insole, and substance of the upper.

It must be evident that leathers of a very stretchy nature would not require the same allowance as hard, non-stretchy material. The whole subject of lasting allowances is a very vexed question, and many a tale could be told of its effect upon the language of the lasting-machine operators!

Seeing that the characteristic of upper stock varies and is not constant in elasticity, even in the same class of skin, we cannot pretend to give exact fractions, since the amount allowed must be made according to conditions which can be determined only after due consideration of the points named. Taking an average for light to medium material, machine-welted work would require ½ in. to ⅝ in. round the seat, and ⅜ in. to ½ in. along the part to be welted. Blake-sewn would require ½ in. to ⅝ in. all round the bottom; Veldtschoens, ½ in. round the seat and ⅜ in. for the remainder; Turnshoes, ⅜ in. to ½ in. Very heavy leathers made screwed, or by any through-seam method, would require at least ¾ in. allowance.

Seam Allowances. Seam allowances must be considered in relation to the nature of material, size of needle, and the number of rows of stitching to be used. Material that is not strong in the fibre requires greater allowance than in the case of a tough-fibred leather; fabrics also require a special amount.

Plain stitched seams should have $\frac{1}{12}$ in. for box calf, $\frac{1}{16}$ in. for glacé kid, $\frac{1}{12}$ in. for glacé sheep or goat, and up to $\frac{1}{8}$ in. for split and kip according to substance.

For lap seams, the amount allowed varies between $\frac{1}{4}$ in. and $\frac{1}{2}$ in. The actual amount could be determined by calculating the space occupied by the rows of stitching plus a clearance for the presser foot of the machine.

The usual allowance for fabric linings is $\frac{1}{4}$ in. The back seam may be taped or covered with a strap, when $\frac{3}{16}$ in. would be sufficient.

Edges that have to be folded must have the folding over allowance included on the working patterns; $\frac{1}{8}$ in. would represent a suitable amount for this purpose, but if the edge is to be plain bagged, only $\frac{1}{16}$ in. would be required.

Grading. Having designed the standard into its sectional parts, with the working allowances included, the next stage is to produce a set of sizes or half-sizes.

This process is termed "Grading," and may be done by hand or machine. The principle of the triangle, applied to the enlargement or reduction of figures, is the base upon which patterns are graded, but seeing that lasts are not graded strictly geometrically, the grade of the patterns must be adapted to suit the lasts, if perfect accuracy is desired.

Grading by hand is a slow and intricate process, and it would require more space than we have at our disposal to describe fully the various methods adopted.

What is known as the "Radial" system is often used, and proves satisfactory if confined to a short range of sizes. The defect of this method is that it is purely geometrical, the width being graded in proportion to length; thus, if the fitting is larger, there would be a slight increase in the grade.

If it is desired to grade a set of patterns by the "Radial" system, the first necessity is to produce a grading tool, or proportional compasses could be used.

Radial Tool. The paper tool is made as follows. Draw a base line A B equal in length to the standard, and at B raise a line at 90° as B C. On the line B C mark off divisions of $\frac{1}{3}$ in. ($\frac{1}{6}$ in. for half-sizes), connect each point at A and cut out.

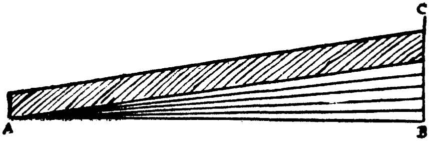


Fig. 31

If the tool is accurately constructed, all the lines should be the same proportionate distance apart.

Seeing that A B represents the length and the divisions on B C the sizes, when the tool is folded or marked perpendicular to the base, any division across the mark would represent a proportion of the size. For example, if a point half-way between A and B is selected, the grade across that part of the tool would be $\frac{1}{6}$ in., as one-sixth is half of one-third; or if one-quarter of the length from A is taken, the grade across that part would be $\frac{1}{12}$ in., seeing that $\frac{1}{4} \times \frac{1}{3} = \frac{1}{12}$. (Fig. 31.)

Method. Any sectional part of the standard may be graded separately, although it is advisable to have as many parts as possible on one stencil.

This could be done by marking the sections on the standard, but for simplicity of description we apply the method to a set of standards only.

With a fine awl, mark round the standard on a sheet of paper and draw a line from toe to counter as A B. On this line select a point for the radial centre as C.

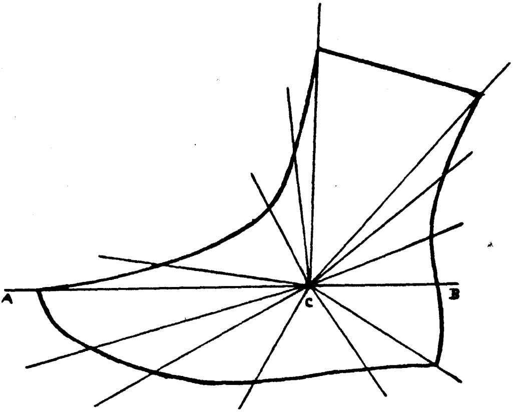


FIG. 32

The most convenient position is at a distance of one-third of the line from B.

From point C take lines radiating across the outline of the pattern at the chief parts to be graded, and, where the lines cross, indicate their position on the standard. (Fig. 32.)

Now take the paper tool; with point A on C and the base on one of the radiating lines, fold over or mark the tool where the line crosses the outline of standard. Transfer the points from the tool to the radial line, inside and outside the standard, according to sizes required.

Repeat the process at each of the selected points, always placing point A of the tool on the radial centre. (Fig. 33.)

By pricking through the points thus found, a stencil is produced, and this is used for making other sizes.

This method would not be suitable for a long run of sizes, or if a fixed grade were required. Under such conditions an adapted grade would be more suitable.

Assuming the standard is size 5 women's, we prick through points representing, say, size 6. This is cut by working from point to point, using the standard as a guide.

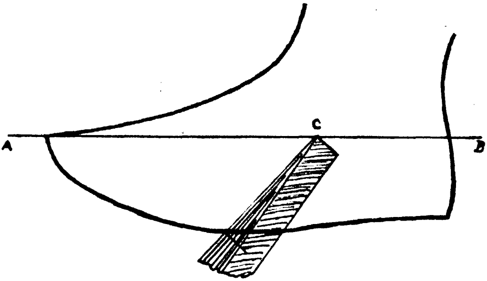


FIG. 33

For the next size use the pattern previously cut, and not the standard. The same would apply to sizes smaller than the original; thus for connecting the points, use size 4 to provide size 3, and so on, up or down.

When grading sectional parts separately, use the same tool as used for the standard and fix the radial centre at any convenient point.

Preparation for Use. Having graded and cut all the parts in paper, the next operation is to reproduce them in some material not easily destroyed. For this purpose, sheet-iron, zinc, and strawboard are used, the last named being bound with metal.

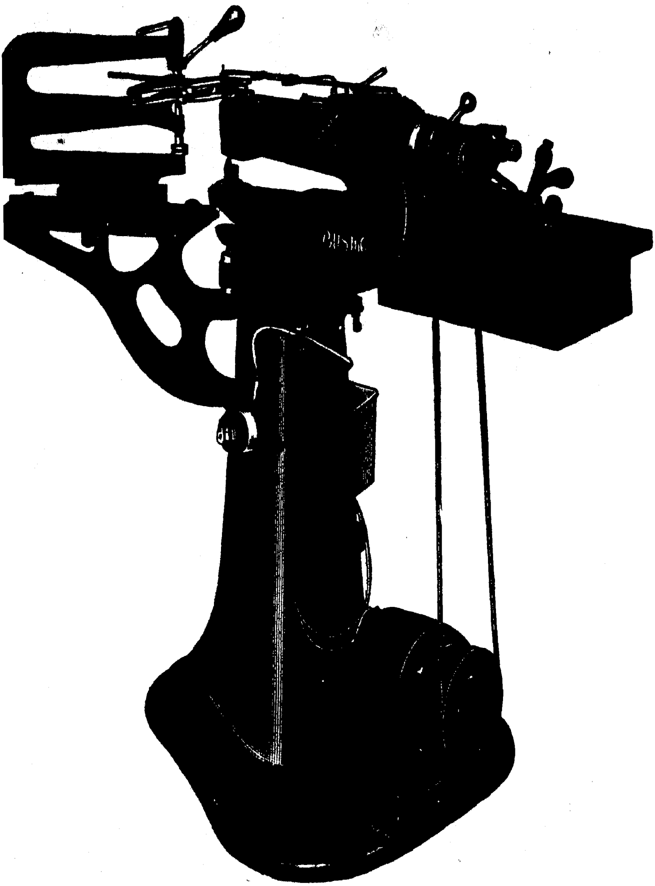


FIG. 34

GRADING MACHINE

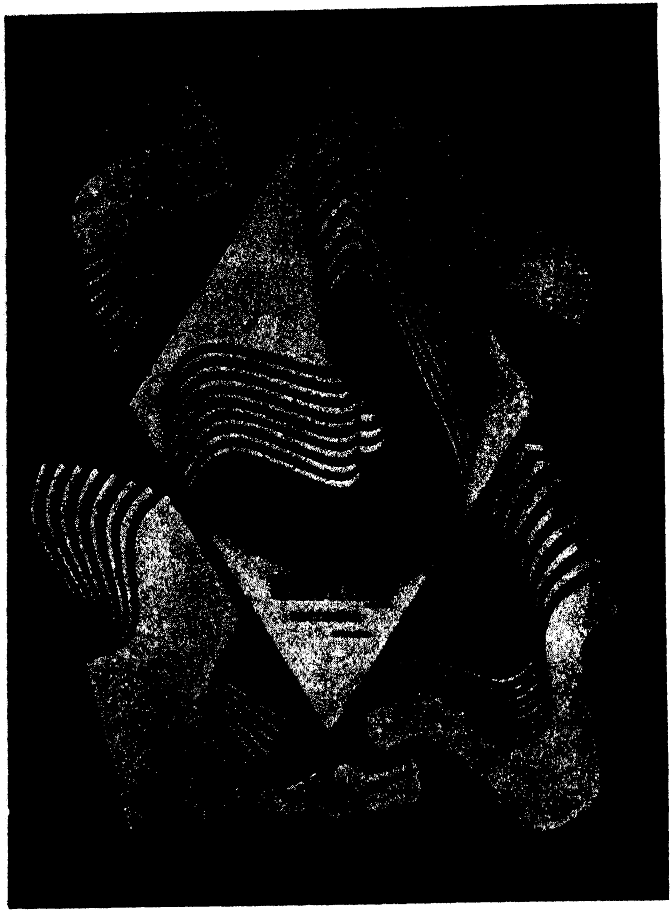


FIG. 35

A COMPLETE SET OF MACHINE-GRADED PATTERNS

If made by hand, the patterns would be marked round on the zinc or other material, and cut out with shears; in the case of metal, the edges would be filed and afterwards smoothed with emery cloth. Prick marks for lap seam allowances, the size, type, fitting, etc., are also stamped on the working pattern.

For a good reason we have described the most expensive method of producing patterns; they may, however, be more cheaply and accurately made by the use of machinery.

Some of the grading machines used will grade and cut the material simultaneously, leaving the binding and finishing off to be done by other mechanical means.

One of the disadvantages of using metal patterns is the liability of distortion, due to wear at important points. When this occurs, a new pattern must be cut, but where metal binding is used, the binding can be easily replaced when worn, leaving the original pattern intact.

The machine illustrated (Fig. 34) is power driven, and will grade and cut patterns from sheet metal or pattern board. A standard section of the average size is clamped in the machine, from which, by the adjustment of length and width scales, any number of sizes may be rapidly produced. The cutting device is a punch, which works at such a speed that it practically makes a continuous cut. For cutting out insertions the punch is raised out of action without stopping the machine, and is lowered again when the pattern is in position for an insertion to be cut.

Fig. 35 illustrates a full set of machine-graded patterns.

CHAPTER V

CLICKING

THE cutting of upper leathers is a branch of the trade referred to as clicking. This rather peculiar trade description originates from the fact that, at the termination of each cut, the knife makes a distinct click.

Like every other branch of the industry, clicking is sometimes assisted by the use of machinery, but not to any great extent. Where large quantities of one type of shoe can be produced, and where the skins and sides are large, the use of the clicking press is justified. The press is also used for cutting fittings, linings, backers, etc. By far the largest quantity of leather is, however, cut by hand, and this will always be necessary so long as we have seasonal changes in shape and design. (Fig. 36.)

Fabrics. In addition to leathers of various kinds, fabrics are used, both for linings and outsides, or covers, as they are often termed. Fabric linings are generally cotton or linen, and the latter is more often used for men's and boys' boots on account of its stronger nature. The quality of the fabric depends chiefly upon the strength of the yarn.

Two kinds of thread are used in making the fabric, warp and weft, and there is often a considerable difference between the strength of the two. Fabrics of *good quality* as used in the shoe trade have their warp and weft threads equal in strength, and this is a great advantage. In the lower grades, however, the weft is weaker; consequently such fabrics have their greater strength in the direction of the warp, which runs in length.

Cutting Fabric Linings. In cutting fabric linings, the width of the lining and the shape of the pattern must govern the selection of any system. Unlike leather, we know just how the material will stretch. As a general

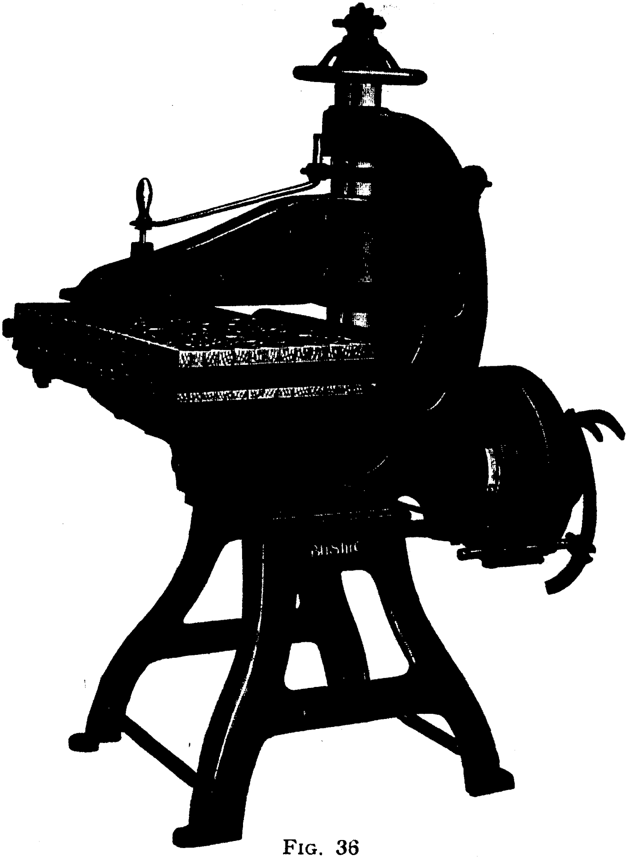
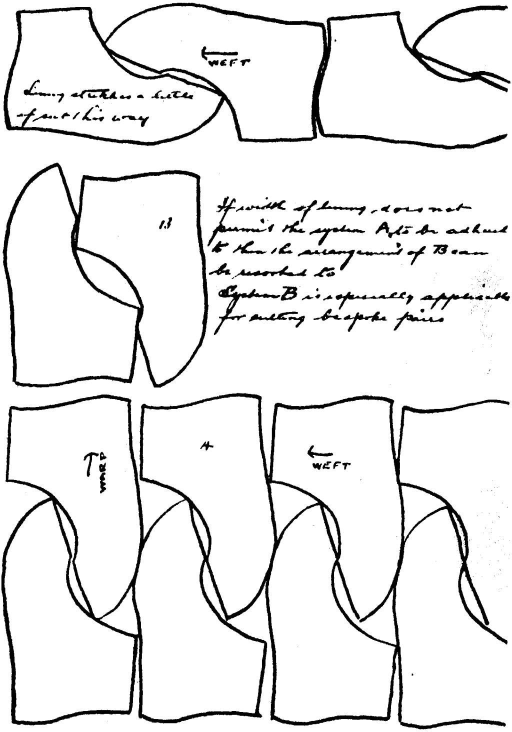


FIG. 36

“IDEAL” CLICKING PRESS

rule, where there is a difference between the warp and weft, linings may be cut in one direction or the other, i.e. with the warps running down the length of the lining or across it. If it is a question of economy, linings should be cut lengthwise of the fabric, or, to prevent "stranding," they may be cut with the warps running across. This is an advantage where the upper has no



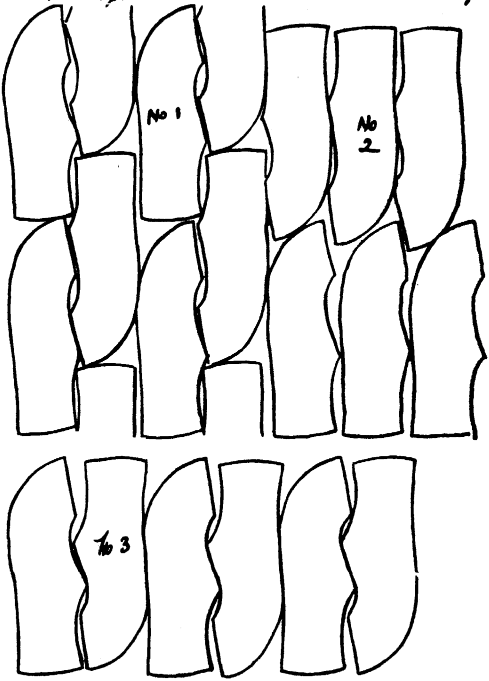
Lining stretches a little [illegible] this way

If width of lining does not permit the system A to be adhered to then the arrangement of B can be worked to

System B is especially applicable for cutting bespoke pairs

Fig. 37

SYSTEMATIC METHODS OF CUTTING FABRIC LININGS toe-cap. Although it is not considered advisable to cut on the bias (twist), there are times when it is better to do so. With uppers of light, stretchy leather, linings often burst at the toe end during the operation of pulling over the last. This is accounted for by the fact that the leather stretches, and the lining will not, if cut by the former methods. By cutting on the bias, the lining will



cutting whole shoe linings from fabric
the shape of the pattern will influence you in deciding
best style – as the most economical in cutting.

FIG. 38

SYSTEMATIC METHODS OF CUTTING FABRIC LININGS give with the leather, and although it is difficult to obtain a clear lining, the defect is balanced by the prevention of ruptured toe linings.

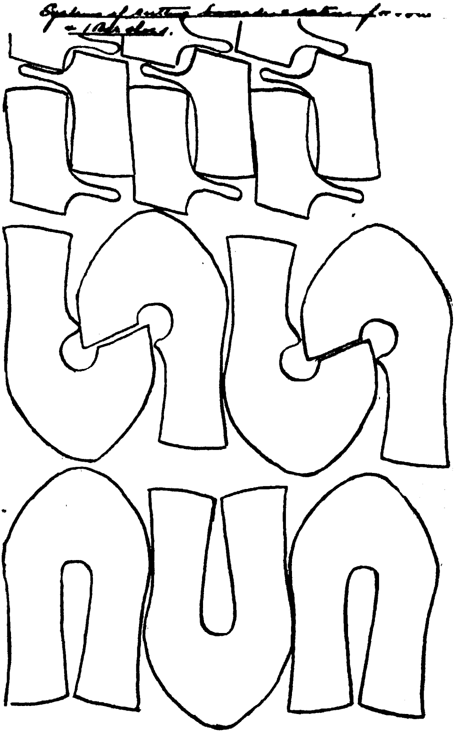


FIG. 39

SYSTEMATIC METHODS OF CUTTING BROCADE COVERS

Systematic methods of cutting fabric linings for boots and shoes are illustrated in Figs. 37 and 38.

Brocades, satins, tinsels, and other fabrics are used for the covers of fancy shoes. Brocades and satins vary in width between 22 in. and 24 in., and this allows for a systematic arrangement of patterns. In cutting satins, etc., the nap of the fabric should be from heel to toe, and where a design is worked on the fabric, it must be seen in full on the centre of the front. Systems for cutting brocades and satins are illustrated in Fig. 39.

Clicking is not simply a matter of cutting skins and sides; it is the first stage in the manufacture of footwear. A good knowledge of the material used is necessary, and much skill is required to dispose of the various parts of the skin in the different sections of the uppers. It is advisable for every clicker to understand something about the manufacture of his raw material. The want of uniformity in similar grades of leather prevents the use of any well-defined system of cutting, although systematic methods of placing patterns upon leather are advocated and sometimes worked to.

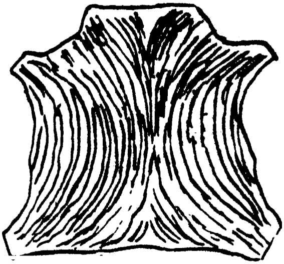


FIG. 40

LINES OF TIGHTNESS

Stretch. One of the first problems the clicker must contend with is the direction of what are termed the "lines of tightness." This is a technical term, applied to signify the direction in which the skin pulls tight. Practically all animal skins pull tight in the same direction. The tightness will be greater in the direction the animal grows in length. Naturally, in skins taken from full-grown animals, there will be a greater degree of difference between the " tight " and the " stretch," whereas in skins taken from young animals the difference will not be so much, although there is always more stretch in width than in length. (Fig. 40.)

The method of tanning and finishing leather will influence the notice that must be taken of the stretch when cutting.

In cutting the best parts of the skin, it is not always necessary to consider the " lines of tightness," especially when such skins are heavy in substance and heavily waxed, but when the lighter parts are reached, and when light, stretchy leathers are used, the patterns must be so arranged that certain parts may pull relatively tight.

With machine-lasted goods, the direction of stretch in the uppers is important. With a good knowledge of the direction of stretch, a clicker should be able to cut any particular part of the upper to pull tight in any given direction.

The value of a skin for a definite purpose is determined by the shape, quality, substance, and size.

Shape. Skins that are fairly square provide a larger prime cutting area than those that are long and narrow. Usually, a well-grown skin is wide in proportion to length, and the relative amount of offal is small and light in substance. Skins varying in substance between extremes are not so valuable as those more regular. Long, narrow skins are generally found to have long and badly-marked necks, which are often very stout; the belly and flank is also poor in comparison with those of better shape.

The sex of the animal from which the skins are taken naturally has its influence upon the substance and quality of the manufactured leather. Female skins invariably produce leather of a finer quality and more even substance than male skins; the distinction will vary according to the type of leather made.

Rounding. Most of the badly-shaped skins could be made more valuable to the boot manufacturer if they were better rounded by the tanner. Since the custom of selling leather by area measurement was introduced, it seems to have been the practice of the tanner to leave on more than is really necessary. Of course, this adds to the area of the leather produced, and, in proportion, lowers the value of the skin to the manufacturer.

The "Tight." There are three ways in which uppers may be cut to pull tight: (1) From counter to toe; (2) across the vamp; (3) in the direction of the seams.

The last-named method is soon disposed of, being used only in special cases. The effect would be to produce uppers with tight seams, and at the same time waste a large amount of material. With very light, elastic leathers it is essential the seams should be tight to prevent them going "on the twist" during lasting. The necessary tightness may be imparted by stitching tape down the seam in closing, or by using adhesive tape. Some makers might object to this process on account of the interference with the natural flexibility of the leather. In practice the effect will be so slight that it may safely be disregarded.

The second method—cutting vamps tight across—is theoretically supposed to assist in preventing "treading over." It must be evident, if the vamps are tight across, they will give in length; this will lengthen the amount along the bottom edge, and, consequently, any tendency to tread over will not be resisted by such means. As a matter of fact, it is necessary, for economy in cutting a large majority of leathers, to cut the vamps tight across.

The former method—counter to toe—is the one most essential for goods made by lasting machinery. By cutting tight in length, more uniformity in appearance may be attained. This is especially noticeable in goods having toe-caps. All the various sections should pull tight in the same direction; unfortunately, this is more easily said than done.

With leather at its present price, it is necessary to utilize every scrap for given purposes. To cut every section tight to toe would often result in loss of material. Much, of course, must depend upon the quality of work produced. If the price of the finished article allows, more liberty may be taken in cutting. On the other hand, if it is essential that every part should be used, then the stretch must be regulated by artificial means. This is usually done by interposing some kind of fabric between the lining and the outside.

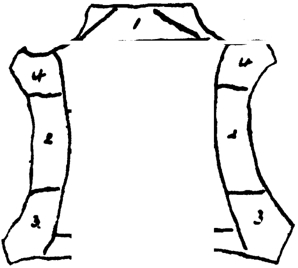


FIG. 41

SUBSTANCE

Substance and Quality. In using the different parts of skins or hides, the relation between substance and quality must be taken into consideration. The best of any given material should be used for the parts of the uppers that undergo the greatest strain during wear, and, to a less extent, during manufacture. In some factories the conditions that arise in wear are seldom taken into consideration. Many of the most modern and far-seeing concerns consider the wear of their productions of the utmost importance, and the quality of the material in the uppers is disposed of with that end in view. (Fig. 41.)

The part of a boot or shoe subjected to the most strain during wear is the front portion. Fronts should, therefore, always be cut from the best part of the skin; toe-caps should also be good. It must be understood there is only a certain proportion of best quality in any skin; the inferior parts should be placed either where there is little wear or strain, or where not so noticeable in the boot.

The top portion of the leg is practically good when boots are discarded as unfit for use, and it naturally follows that the light and inferior parts of the skin could be utilized for that portion. For the sake of appearance, some discretion must be used to prevent material of a loose nature being placed here.

In certain kinds of boots, e.g. unlined kip and split, and others of a similar nature, the clicker is tempted to cut the top portion of the leg out of material that is too good. This generally results in inferior material being placed where there is much wear or friction. In this instance, the inferior parts would be backed up by the inside fittings, in addition to the stiffener. The defect would be noticed only by an experienced person, although it would soon become apparent in wear.

Strain. One or two examples may with advantage be given, relative to strain during wear and manufacture.

In a boot, the greatest strain in wear will be: (1) across and at the sides of the front; (2) lower end of and facings of legs; (3) top of counter; (4) across the heel line. During manufacture: (1) top of counter; (2) end of toe; (3) across the front; (4) facing and side seams.

In a shoe, during wear: (1) as in first example; (2) at the back, just above the stiffener; (3) end of quarters and facing. In manufacture: (1) the ankle curve; (2) end of quarters and facing; (3) the front.

In other special kinds of boots or shoes, the strain would be as explained, but the term of location would be different.

Although quality and substance in leather do not always coincide, the disposition of substance is an important factor and affects the appearance of the made-up goods as well as their utility.

In practice, it is the custom to dispose of the stoutest material into the largest sizes of the range being made.

This might appear to be rather unfair to the wearer of small sizes; as a matter of fact, wear is not affected providing quality is present. If the stoutest material were used for the small sized goods, they would have a stumpy appearance compared with others made on a larger last.

With regard to the substance of various parts of the upper, the stoutest is required where there is the most wear and tear. The front naturally conforms to this requirement. Where toe-caps are included, there is no necessity to cut as stout as the front; they must be firm and good, but it is an advantage to have them less in substance. The top part of the leg in a boot demands flexibility if it is not to interfere with the natural functions of the foot.

In certain classes of leather (for instance, low grade glacé skins) the substance is often very uneven. The clicker often finds material of good quality but poor in substance; hence, for the appearance of the upper, the substance must be made more equal. Again, in cutting for economy, the substance of certain parts must often be disregarded. In both instances this may be remedied by the inside fittings, or by what are termed "backers."

By some, "backing" might be looked upon as a deception. It would obviously be out of place in uppers intended for hard wear, but for light productions, the uppers of which generally outlive the bottoms, the practice is quite harmless and tends to produce more satisfactory work.

Systematic Cutting. For economy in cutting, it is advisable to be familiar with various systems of arranging patterns. In the old days, when some parts of the boot or shoe were cut from a different material from that of the main portion, systematic arrangement was very valuable. At the present time we are having a repetition of the same; the leg portion is cut from fabric or dull-finished leather, and the vamp or golosh from an entirely

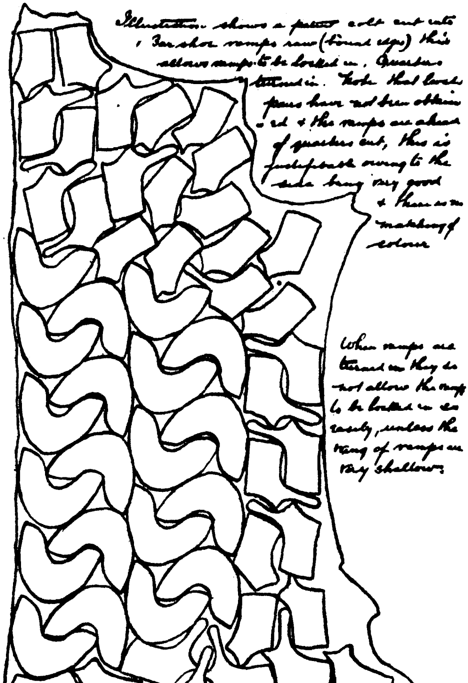


Illustration shows a pattern cut out into 1 Bar shoe vamps raw (turned edge) this allows vamps to be locked in. Quarters fitted in. Note that [illegible] pieces have not been obtained & the vamps are ahead of quarters cut, this is justifiable owing to the side being very good & there is no matching of colour

When vamps are turned in they do not allow the vamps to be locked in so easily, unless the wing of vamps are very shallow;

FIG. 42

SYSTEMATIC METHOD OF CUTTING LADIES' BAR SHOE UPPERS

different material. There is no doubt that where a particular part of the boot or shoe has to be produced in quantity, irrespective of the remaining sections, systematic cutting should be resorted to.

When small skins are cut into complete pairs of boots, systematic arrangement is possible only with certain parts. The vamps or goloshes may be worked to a system, but, on account of the variation between skins in inferior parts, it is unusual to be able to work to a system for the other portions, although some general order of arranging the patterns may be resorted to. In cutting large skins and sides of good quality and regular substance, systematic methods are quite possible, especially where the patterns are some variety of shoe or slipper. With the production of one part only from a skin, systematic cutting is easy. Some methods of arrangement produce work for one side only, and this plan would require a skin of similar quality and substance to complete the opposite side. Where this is not possible, a system of cutting in pairs is used. Fig. 42 shows a system of cutting a lady's one-bar shoe from a patent side. In this instance the vamps are designed for burnished or bound edges, otherwise they would be more difficult to interlock. On account of the quality of the side, complete pairs are not produced, therefore the remaining quarters required would be produced from an inferior side. Fig. 43 illustrates a system of cutting a good, clear, box side into a lady's boot, with a fairly high leg, and Fig. 44 a box calf skin into two qualities of a one-bar shoe.

The selection of a system chiefly depends upon: (1) the shape and height of the pattern; (2) the class of work to be produced; (3) the nature of the material to be used. If the nature of the material, or any other reason, prevents the general adoption of a system, the edges of patterns similar to each other should be placed together.

Patterns of the same area measurement but of different design will give different results in cutting. For the purpose of selecting the best system to adopt, it is necessary to know the superficial area of the patterns used, in addition to the cutting area. The minimum cutting area may be found by marking several pairs of

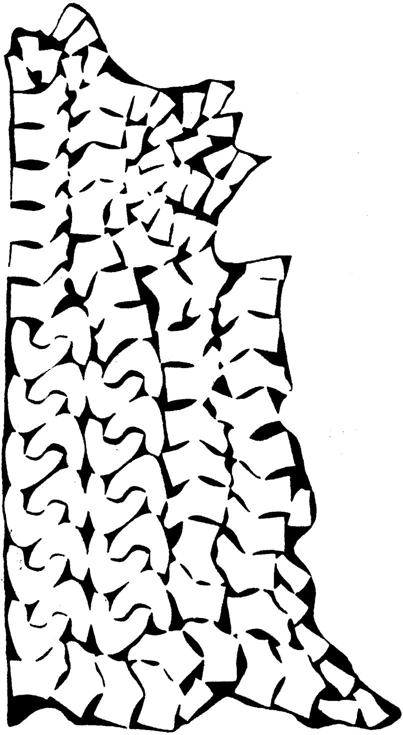


FIG. 43

SYSTEMATIC METHOD OF CUTTING LADIES' BOOT UPPERS

the particular parts on a sheet of paper, afterwards finding the area of the space enclosed by all the patterns. This should be repeated with every known arrangement of patterns, and the method that produces the best result may then be adopted. It must be understood that

Box Calf 1 Bar No 1 Grade will chop—
shoe pairs (pressed bar shoe)

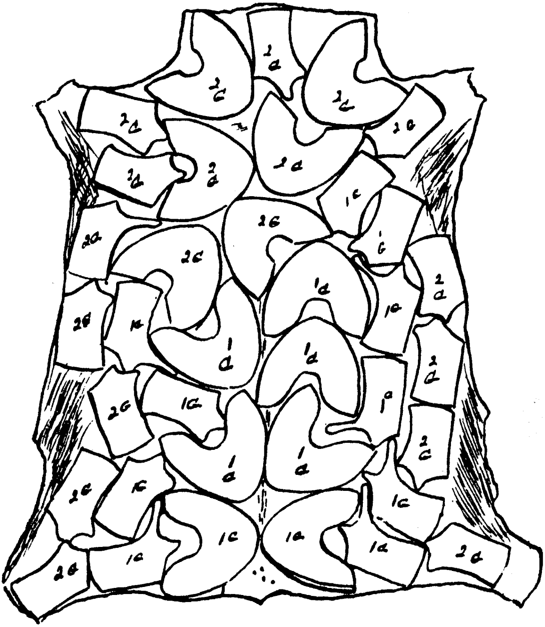


FIG. 44

METHOD OF CUTTING A SKIN INTO TWO QUALITIES OF BAR SHOES

this process will only determine the possibility of the best arrangement of the patterns.

For costing purposes, the actual cutting area of any design must be obtained from an average parcel of material. Sample dozens of skins should never be tested, but a quantity from the bulk should always be selected. A description of some simple and practical methods of dealing with areas will be found at the end of the chapter.

In a large parcel of skins supposed to be of the same quality, a certain amount of variation in substance, shape, and quality will be found. For this reason, it is necessary to sort the skins. A leather sorter, who, by experience, becomes very expert at the work, is usually employed, although in small factories sorting is often left to the discretion of the clicker.

Principles. Before cutting, each skin should be examined for possible flaws on both sides of the leather, and the defects marked with a blunt awl. It is often possible to work in some of the small defects by placing them where they will be covered by a lap seam or on the lasting-over edge.

On skins, cutting may be commenced by working each side of the back-bone, or from the left flank, according to the substance and quality of the bottom part of the skin. Where the back-bone is prominent, and the butt end is not clear of defects, it is advisable to commence at the back-bone, and if flaws of any considerable size occur, the best policy is to work away from them.

In cutting sides, i.e. a skin divided down the back-bone, cutting should commence at the butt end. Different sections of the upper should be cut to " mate " in quality and appearance. When the parts are cut in large quantities, the mating is usually done by a sorter; where, however, only small quantities are produced, it is left to the foreman or the clicker. In wholesale work, this detail is often very much neglected; one upper in a pair may be totally different in appearance from the other. It is not always possible in practice to mate completely all the various parts, but, at the worst, corresponding parts should match.

Coloured leathers require more skilful treatment. The colour varies in different skins, sometimes in a single skin; consequently, complete pairs should be cut, and where variation in shade is unavoidable, parts that join should be of the same shade. With careful cutting, a distinct difference in colour could be disposed of in the parts of the upper not so noticeable.

A considerable amount of skill is required to mate the caps and vamps, particularly in coloured work. On account of the casing under the toe-cap, and the amount of strain it is subjected to in making, allowances must be made if similar appearance is to be obtained.

Coloured leathers have a tendency to become lighter in shade when strained to any extent; the obvious remedy, if an even shade is desired, is to cut such parts a shade darker. Many coloured leathers are now manufactured with a pigment finish, and this often creates some special difficulty later on. Such leathers are very much easier to deal with in the clicking room. As a general rule, pigment-finished leathers are uniform in colour all over the skin; consequently, they may be treated in the same manner as black-finished leathers.

Methods of Cutting. There are three general methods of cutting: (1) the exhaustive; (2) the selective; (3) a combination of (1) and (2).

By the first method, as its name implies, the material is completely exhausted. The skins or sides, after being sorted, are cut up into the kind of work they are most suitable for. A large number of patterns is required, as every available piece of material must be used up. With this method the necessity of sorting after cutting is evident; otherwise most of the uppers will be anything but uniform in quality and appearance. As several qualities will be produced, this method is suitable only for firms having a large and varied output. Some of the small firms adopt the same method, and even omit to sort the cut stuff; hence the appearance of the bulk of their work suffers in comparison with others, who probably use the same class of leather but sort the resultant production.

The "selective" method is used where quality of work is the first consideration. The leather selected should be of good quality, and only the best part would be cut. The inferior portions would either be sold, or used for other purposes. For average factory work, such a method of cutting would entail much expense, and the application would not prove profitable.

The third method, a combination of the first and second, is in practice the most adaptable to ordinary conditions. The leather is selected as nearly as possible according to the quality and class of work required in bulk, and where it is not suitable for the particular boot required, other kinds are worked in and used for other tickets.

Selection of Material. Selection of leather for making various classes of goods demands some consideration. Leaving out the question as to what takes place during manufacture, the use to which any kind of footwear is to be put will help to decide the class of leather most suitable.

Roughly speaking, upper leathers, as known to the trade, are classified under several headings: (1) vegetable tanned; (2) chrome tanned; (3) tawed; (4) combination tannages. Each tannage provides us with leathers having distinct characteristics. The ideal leather has not yet been produced, although many are almost ideal for specified purposes. A good upper leather must not be air-tight, but nearly waterproof; it should withstand bending and tearing strains, and be able to resist friction.

Vegetable tanned leathers, especially when stuffed with wax, withstand a large amount of friction; their ability with regard to tearing strain is not so great when compared with some of the mineral tannages of equal substance and quality, neither is the flexibility so great.

Chromed and tawed leathers are most flexible; they do not tear easily, and will stand any amount of bending before becoming exhausted, but their power to resist abrasive friction is not great.

Leathers made by combined processes generally have the characteristic of the first tannage used. There are many combinations, chief of which are: (1) vegetable and chrome; (2) vegetable and alum; (3) synthetic and vegetable. A good example of the first is known as semi-chrome, the chief character being that of ordinary vegetable tanned leather. It is a poor substitute for full chrome and should not be used for boots intended for hard wear.

For light or medium wear, a chrome leather answers all requirements, and for hard wear an ordinary vegetable tanned leather, made in conjunction with a synthetic agent or otherwise, and thoroughly waxed, is probably the most satisfactory.

Some of the heavy chrome tannages produce leather suitable for sporting boots, but for agricultural or mining purposes such leather is not as good as the ordinary tanned and waxed productions. For dress, or indoor wear, there is no necessity to be too exacting about the material used. If the leather is flexible and good in appearance, most of the other features are only of secondary importance.

Characteristics of Skins. Many varieties of animal skins are now used for the manufacture of upper leathers. In addition, the skins of various reptiles, and of the shark and ostrich, are used. Obviously it would be impossible to deal with all the varieties within the scope of this work, but a reference to a few of the most popular types should be of general interest.

Calf skins are very tough as regards their ability to withstand tearing strains, and they are close in the fibre, but, unfortunately, what are known as growth marks are often prevalent, especially in the necks of skins produced from male animals. The flesh side has a fine surface and is often finished with a *suède* finish. Wax calf is also finished on the flesh side. Others, such as box calf, willow calf, etc., are grain-finished leathers.

Glacé kid skins are produced from young goats before they shed their first coat, and are finished on the grain side. They have a fine surface and are light in substance. Goat skins are often sold as kids, and although many produce a fine leather if taken from a young goat, they cannot be classed as kid. The true kid skin should not exceed 5 sq. ft. in measurement. Goat skins have a prominent grain, which varies considerably, according to the origin of the animal. The chief sources of supply are India, Brazil, Mexico, Russia, Asiatic Turkey, and South Africa. They are finished in a variety of colours and are used for many purposes in shoemaking. Being rather harsh in nature, they will not withstand the same amount of strain as calf skins. Sheep skins are very largely used, more often for the linings of boots and shoes. The tearing strain is not equal to that of the calf or goat; the skin is soft to the touch and stretchy, and will not withstand abrasive friction.

Reptile skins used are those of the lizard, crocodile, and snake. The best lizard skins originate from Java, and their chief feature is the irregular markings of the skin. Indian lizard is more uniform in the grain. In the centre of the skin it is pebbly in appearance, while near the edge it finishes with a straight grain. The skin of the

Talagoya lizard is the reverse of the Indian, the grain being straight in the centre and pebbly near the edge. Leather made from crocodile skin is generally well-known as far as the appearance is concerned. For shoemaking purposes the skins must come from a reptile about 2 ft. long or under, otherwise the scales will be so hard and the skin so thick that it will be almost impossible to machine the uppers. Even leathers made from the skins of the young crocodile present a difficult proposition to the machinist, and it has been found necessary to produce a special needle for use in closing the uppers. Snake skins mostly come from tropical countries and from reptiles that are not poisonous. Skins from the karung, or water snake, come from Borneo and Java, and the snake is generally caught in the rainy season by means of a line and hook. They vary according to age but do not often exceed 4 ft. in length. The skin of the python and boa constrictor is often used. The python is very common in India, Java, and Borneo, whereas the boa constrictor is more often found in South and Central America. Such reptiles grow to a large size, and we have seen skins measuring over 30 ft. in length. The characteristics of the markings vary; on the python they are sharp and angular, and on the boa constrictor the markings are not so well defined.

The colour of the finished leather produced from snake skins depends very much upon the method of tanning and also upon the speed with which the reptile is skinned after death. Many imitations are made, sometimes from calf skin or the skin of young buffalo, and often from the skin of the Persian sheep. Such substitutes should not be difficult to detect by careful examination, as in all cases the grain is printed or embossed.

Methods of Buying the Skins. In the old days upper leathers were bought either by weight or by hand. The latter method is now practically obsolete, but where skins are offered under these conditions, vast experience and keen judgment are required by the buyer. Heavy leathers, such as waxkip, wax split, and wax calf, are still bought by weight; the majority of leathers, however, are purchased by area, width, or length.

Where the leather is bought by weight, any additional substance must necessarily add to the cost of the cut stuff. At the same time, such methods of selling offer scope for the weighting or adulteration of the leather. The extra weight may be only an excess of oils or waxes, or probably some mineral matter, but as there are no wearing properties in such constituents, leathers of that character should be avoided.

When bought by area, the square foot is the unit of measurement, and the skins are measured to the nearest ¼ ft. Since there is no incentive to add additional weight, nothing would be gained by adulteration. Superfluous area may be resorted to by full rounding, as mentioned previously, but that would not apply to good grade skins.

Reptile skins of certain kinds are bought by the inch, and seldom by square measure. Lizard skins, for example, are bought by the inch, measured across the widest part of the skin. On the other hand, python skins are bought by length, and so is the skin of the water snake, although occasionally exceptions may be made in this variety.

Area Measurement. Where the size of the factory permits, a measuring machine should certainly be included in the upper stock department, and where a machine is not possible, some method ought to be at hand for testing the measurement of purchased material.

The actual cost of the cut stuff can be ascertained only by careful checking, and it is essential that the area of a parcel of leather should be marked accurately. For many reasons, there is often an apparent difference in the total measurement of a parcel of leather, as marked, and it need not be said that the difference is often against the buyer.

The mechanical means of measuring is undoubtedly the most rapid and accurate, if proper steps are taken to adjust the machine as required. The initial expense, however, prevents many of the small firms using a machine, although much could be done on a co-operative basis.

Failing mechanical means, an instrument known as the " areameter " could be utilized, although in a sense this, too, is mechanical. If it were necessary to measure a whole parcel of skins by this means, the procedure would be very slow; in fact, it would be advisable to select a few skins for a test rather than attempt to measure the bulk. The areameter consists of a solid centre (which is placed on the centre of the skin to be measured), from which radiates a bar with a pointer at the extremity. As the pointer is moved round the outside edge of the skin, the measurement is registered on a dial which is arranged on the centre piece.

Methods. For occasional testing of areas on small skins or patterns, other methods may be adopted. The method of placing the skin upon a board, marked with squares of known measurement, is fairly accurate. The same principle could be applied to a pattern, but the squares in this case would have to be much smaller; even then, there is a certain amount of approximation, as the outline of the pattern will not always oblige by passing over a complete square.

Triangulation. A geometric method of marking the outline of a skin or pattern into regular or irregular figures, such as rectangles, triangles, etc., is often employed. The accuracy of this method depends upon the skill used in marking up into these figures. For example, the skin or side would be outlined on a sheet of paper. The outline would then be marked into the smallest number of figures possible, and the area of the figures found and totalled by the decimal system of calculation.

To be able to use such methods, a knowledge of geometric figures, and the methods of finding their areas, must be known. The average technical student would be well acquainted with these, but the average workman would be a stranger to such procedure.

Fortunately, there are other means by which areas may be ascertained with exactitude.

Weight. The only requirements are a balance or scales capable of weighing to a very small amount, and some paper of even texture. To find the area of a skin, first cut the exact shape out of paper. From the same kind of paper, cut pieces of known measurement, say, several of 1 ft. square, ½ ft. square, and down to ⅛ ft. square. Then place the paper representing the skin on one side of the scales and balance with the paper weights. The area represented by the pieces used to balance will be the area of the skin.

Alternative. An alternative method would be to weigh the paper shape first, then cut out a square foot from the shape and weigh that. Divide the weight of the square foot into the original weight of the shape to obtain the area.

For patterns, the latter method may be used with advantage. After weighing the pattern, cut out a square inch and divide the weight of the inch into the weight of the pattern. In this instance the answer will be given in square inches.

CHAPTER VI

PREPARATION FOR CLOSING

AFTER cutting and assembling the various sections of uppers according to the number of pairs indicated on the work tickets, the next series of operations is to prepare the sections for fitting and machining together. In small, and many medium sized, factories the preparation is made in the closing room; in fact, it is looked upon as an integral part of that department.

Where the quantity of work is not great, this would be better if done in the clicking room, where any spoilt parts and other defects could be remedied before going forward, or before the work was put up into lots. By the adoption of this method, the cut stuff would arrive in the closing room ready for instant operation.

In large factories, the advantages of keeping these operations separate from closing is readily seen; consequently, they are carried out in a special department, which is situated between the clicking and closing rooms.

The amount of preparation required will, to a large extent, depend upon the class of upper and how it is to be closed. A little extra expense incurred here will fully repay the cost; it is useless expecting a machinist to produce good work if the preparation in the first place has been done without any regard to the after appearance of the upper.

The operations of the preparation department may include counting and checking the cut stuff, marking, skiving, folding, perforating, gimping, pricking, and backing.

Marking. This may be interpreted in two ways: (1)

marking the designs for stitching, and (2) marking the linings and cut sections with the sizes and other necessary distinctions that prevent the wrong parts being put together.

In the first instance, boots, and more often shoes, especially many varieties of the popular ladies' bar, have fancy designs stitched upon the upper. In the event of the upper being of the lace-up variety, facing rows are often required. For the latter, a facing marker would be used in conjunction with a tracer for making the mark or outline of the facing. Where the uppers are cut by machine, the marker could be included in the knife. In the event of any particular design being required this would be done by means of a template and the tracer. Marking the cut sections under the second heading may be done in several ways. Take, for example, the linings. Some indication of the size, fitting, and type is required. For speed and clearness this may be accomplished by a lining marking machine. With the covers, some other method must be adopted in order that the parts may be identified during any of the subsequent operations. A popular plan is to paint the edges of the sections with a stripe of some particular colour, each colour or combination of colours representing a certain size, e.g. size 3, green; size 4, red; size 5, blue, and (say) size 6, white. In every instance the colour would be applied where it could not be seen in the completed shoe. Or, again, the sizes could be indicated with an iron stamp on the lasting edge or on the underlay of other parts. In addition, code marks might be used such as are usual on the knives used for machine cutting.

Skiving. Skiving is a necessity; the word "skive" is given in the dictionary as meaning to cut, or to pare off. Paring off is really what happens when the sections are skived, only the manner by which the paring off is done must be regulated by circumstances. For our purpose, skiving is the reduction of substance at the edge, and it is necessary to reduce the edge of any parts of the upper that are seamed together, otherwise the seams would be too bulky and the uppers very uncomfortable in wear.

To obtain the best results in closing, "green labour" should never be used for the operation of skiving. Uppers may be made with various kinds of edges, different seams, and cut out of material vastly different in nature; therefore, the skive must be regulated to suit all these varying conditions.

One might often go into a factory and watch a small girl feeding all the parts through a skiving machine set at one depth, which is simply asking for trouble. Care must be taken not to weaken the material where it joins with another part, and where one section overlaps another no increase in substance should be noticeable. The chief aim of the operator should be to enable the upper to be closed so that the natural flexibility of the material is retained when the seams are made.

We find it impossible to enter into all the details of skiving; a few examples may with advantage be given, which, with intelligent application to other conditions not mentioned, would enable or help anyone to adapt the skive according to circumstances. An explanation of the terms used in relation to the seams and edges will be given later; our purpose at present is to emphasize the importance of skiving.

Most of the various skives used have some relation to the edge of the upper or to a seam. Generally speaking, the skives required for various purposes may be classified under the following headings: (1) edge skive, (2) plain seam skive, (3) underlay skive, (4) folded skive, (5) bagged skive.

The first is not necessary on light leathers of even substance, but is required where the substance is uneven, or where the edge is thick. No definite allowance for the width and depth of the skive can be stated, as both will vary according to circumstances. The second (plain seam skive) is required where a plain, or what is sometimes referred to as a closing seam, is used. This should be a flat bevel, uniform in width and depth. The width may vary from $\frac{1}{32}$nd of an inch to $\frac{1}{8}$th of an inch, and the depth is, as a rule, half the substance. On very light leathers this may be unnecessary. The object of such a skive is to enable the seam to be rubbed down flat. It also adds to the appearance of the work, gives increased comfort, and prevents strain being placed on the seam. The third (underlay skive) is necessary on the parts that lap one over the other. The width is indicated by the pattern cutter, and will vary on an average from $\frac{1}{4}$ in. to $\frac{1}{2}$ in. In order to allow the stitches to enter the original substance of the leather, such skives should not be taken the full width of the allowance, but $\frac{1}{16}$ in. less. From this margin the skive should be taken to a fine feather edge. The fourth (folded skive) is used where the edges of the upper are to be folded or turned in, the fold being made by turning over the outer surface of the material. Assuming the allowance for folding is $\frac{1}{8}$ in., the length of the skive would be $\frac{1}{4}$ in.; in other words, twice the depth of the fold. In thickness, the skive should equal half the original substance in the centre, tapered to a fine edge at the extremity; this would produce an equal substance all over, with no weakening of the edge. If an attempt is made to treat heavy leathers in this manner, suitable allowance must be made for the slight amount taken up by the action of folding, otherwise a weak margin will be found near the edge. The fifth (bagged skive) depends upon the form the edge will take when made. The object is to prevent a bulky edge, and in order to obviate weakness such skives must not be reduced to a fine feather.

Machine skiving is far superior to hand work, both for speed and quality of output. With the old type of machines, the work was fed against a fixed knife, and for solid waxed leathers proved very satisfactory, but the advent of mineral tannages and altered conditions made them of less use, since a satisfactory skive could not be obtained.

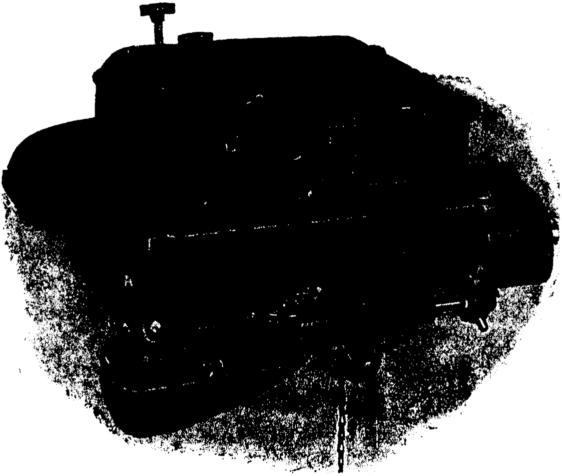


FIG. 45

"MARVEL" SKIVING MACHINE

Machines Used. The "Fortuna" and "Marvel" machines are two of the most modern now used. The chief difference between the two is in the shape of the knife. The "Fortuna" has a cylindrical knife that rotates at a rapid rate and at right angles to the direction of the feed. The feed roll is made to suit materials of various kinds, from a heavy and close-fibred leather to a light and loose-fibred one; the depth and shape of the skive may also be regulated to suit any requirement. The knife in the "Marvel" machine is a disc, and the feed roll rotates with the knife running at a tangent to the feeding surface. Unlike the old class of machines used for this purpose, it is almost an impossibility for the operator to get injured when the machine is in motion. (Fig. 45.)

The majority of uppers produced in normal times are made with folded edges. After skiving, the edge to be folded is coated with a thin layer of rubber cement, the depth of the layer covering the part skived. This operation is also better and more cheaply done by using a cementing machine, which spreads the solution evenly and does not use more than is required.

Folding. The actual fold may be made by machines of two distinct types. One type, known as the "Booth and Boston" folder, works by means of a template, shaped to coincide with the shape of the part to be folded, the whole edge being turned over in one operation. Another kind of machine, like the "Rapid Hand Method Folder," for example, folds the edge in small sections; in this case the part to be folded is placed against a gauge, a feeding arrangement carrying the work forward and folding it at the same time.

Machines of the former type require templates for each distinct shape, and in order to save expense some firms make one shape answer for a series of patterns. This, therefore, amounts to standardization of curves or outline and destroys much of the possibility of originality. There is no sense in spoiling the ship for the want of a coat of paint, and extra expense in templates will undoubtedly be justified if quality of work and style in production is desired. (Fig. 46.)

Perforating. Perforating is the row of ornamentation seen along the upper edge of toe-caps, or round the edge of vamps; sometimes on other parts, too. In certain classes of work this is very often carried to extremes, and the boot or shoe looks more like a Chinese puzzle.

Within reason, perforation, if the design is in harmony with the upper, helps to set off the appearance of the boot; otherwise, it is a defect, and would probably get on the nerves of anyone of average artistic temperament.

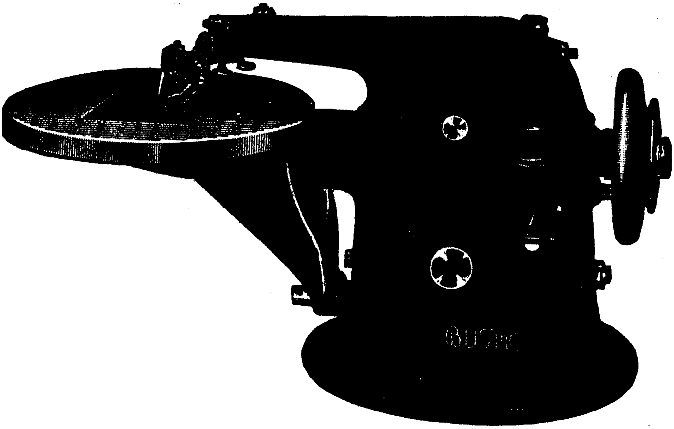


FIG. 46
"RAPID" HAND METHOD FOLDING MACHINE

This operation may be done by machines of various kinds. For toe-caps, a template shaped to coincide with the curvature of the cap, and having the necessary pins, of the design required for perforating the leather, is placed in a kind of press which forces the pins through the material; or a machine having a similar action to a sewing machine could be used. For parts other than toe-caps, the latter type is necessary, and even for caps a larger variety of perforations could be used, at less expense, than with a machine of the former kind. (Fig. 47.)

Other items included in preparation of uppers, such as fixing backers, colouring edges, pricking, etc., are so simple that very little description is required.

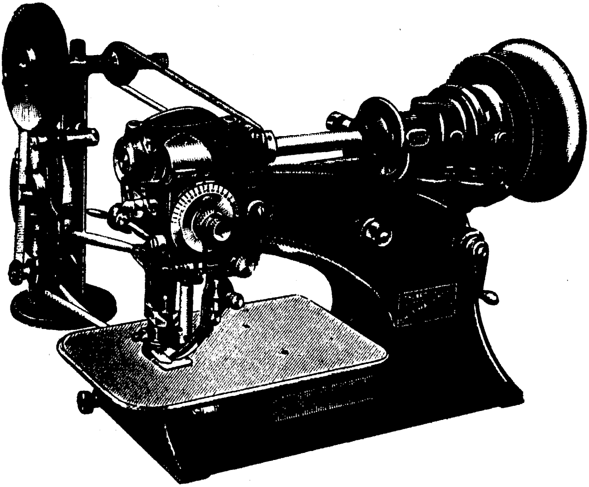


FIG. 47
"ROYAL" PERFORATING MACHINE

Colouring Edges. In the case of raw edges, it is advisable to ink or colour them according to the shade of the leather. A small quantity of gum solution should be added to the colouring medium, to prevent the colour running over the edge; the gum also allows the colour to dry with a polish, and not dull, as would otherwise be the case.

Assuming the various sections to be now prepared, they would be assembled and made up into lots corresponding to the order or ticket, and then passed forward, complete and ready for work, into the closing department.

CHAPTER VII

UPPER CLOSING

THE various methods of closing are carried out by a large number of sub-divided processes, with the help of female labour.

The actual method employed will depend upon: (1) the kind of seam used; (2) the nature of edge desired; (3) the style and class of upper to be produced. Both the seam and edge should have some relation to the nature of the material used and the purpose for which a boot or shoe is to be used.

Treatment of Edges. In ordinary classes of work, the edges mostly used are termed: (1) raw; (2) burnished; (3) folded; (4) bagged; (5) bound. The object in treating the edges is to add to the appearance, giving neatness and finish to the upper, and often increased strength.

Raw Edge. This imparts a solid appearance to the work and is also durable. After a few days' wear it naturally becomes smooth and rounded, and is thereby improved in appearance. A plain-looking raw edge would be out of place on a good class light glacé shoe, as it would appear similar to a person run down, "in want of a tonic"; on the other hand, a folded edge would not be in harmony with a heavy upper made from a thick waxed leather.

Burnished Edge. After being edge-skived, and coloured, the work is fed against an electrically-heated needle, which burns the edge of the leather, causing it to harden and curl over. This gives the work a turned-in appearance. Owing to the heat of the burnisher it is not advisable to treat vegetable-tanned leathers by this method, since it would cause the edge to become brittle. For chrome-tanned leathers, and especially chrome patent, burnishing is to be preferred to folding, as the latter process often cracks the enamel.

Folded Edge. We have already referred to the folded edge. Such edges look neat and wear well. Another advantage is that folding adds to the strength of the edge, because it produces two grain surfaces on the one substance.

Bagged Edge. This particular type may be used on the top of boots or shoes. On account of the speed with which it is produced, it is a popular edge under certain conditions. The formation of the edge may be varied according to circumstances, (1) where the seam is central, (2) where the seam is pulled down on the inside.

Assuming that we wish to treat the top edge of a shoe quarter by this method, the lining and quarter would be faced and a plain seam run along the edge, as narrow as possible. The lining and outside would be turned face outwards and the edge pushed into shape on a bagging machine. If the seam was to be central, a row of stitching would now be run round close to the edge. The defect of this type is that the stitches used in the first instance for joining the edge together all show on the centre of the edge. By pulling the seam down on the inside, such defect is obviated. The extreme edge would then appear similar to a fold.

Bound Edge. Various methods of binding are used and may be classified under three headings: (1) flat bound; (2) French or narrow bound; (3) roll bound. The binding material, which is about ½ in. wide, is cut from very light leather or fabric; for this reason it should not be used on uppers intended for hard wear. Flat binding is stitched over the edge in the form of a U, the edges of the binding showing on both sides. Although often held by hand, it is advisable to use the special machines provided for the purpose. This type of binding is often preferred for the slipper, Court shoe, and bar shoe, being more rapid in application and not so expensive in production. French or narrow-bound work is treated differently. The binding is faced on to the part to be bound, and stitched round close to the edge. The seam is rubbed out; the binding is pulled over and cemented on to the inside of the upper. Afterwards the linings are fitted on to the top of the binding and machined round, leaving the edge with a neat, narrow bead. This binding may also be applied by special machinery. Roll-bound work is made in a similar manner, only the outsides and linings are previously fitted together. The binding is faced to the outside as before, but is brought over on top of the lining, when it may be either felled or stitched round.

Seams. Seams are closely allied to edges. The kind to adopt will chiefly depend upon the purpose, the material used, and the appearance desired. For average purposes, the seams mostly used are known as: (1) lap, (2) plain or closed, (3) silked or open-stitched, (4) welted, (5) overseam, (6) French.

A lap seam is the one most often used, and is made by stitching one part over another; if the tension on the thread is properly regulated, the seam is one of the strongest made. Many examples could be given illustrating the application of this seam; one or two will, however, be found sufficient. The attachment of the toecap on to the vamp forms a seam of this description, and stitching the vamps on to the quarters of a bar shoe is another. Linings are also stitched to the outsides by means of the lap seam. Assuming the parts have been properly skived, the seam should be flat and not bulky. On very light materials, one row of stitching will be sufficient; two, three, or more rows may, however, be used if required. Very little advantage is gained by having too much stitching; the apparent strength is a fallacy, especially when the rows of stitching are close together.

The plain or closed seam is used very extensively. It is made by facing two parts together and running a row of stitching close to the edge. It is advisable to make the seam on a machine having a trimming attachment, which cuts the leather off close to the stitches. The parts are then opened out and the seam is rubbed down by means of a seam-rubbing machine. Where strength is required, the plain seam is not suitable. Such seams should be used only for the parts having very little strain placed upon them, or where the seam may be covered. One often notices the back seam of a shoe intended for infants' or children's wear closed with a plain seam. As a rule, they soon burst open, often before manufacture is completed. Therefore, in goods intended for children, stronger seams should be used.

A silked or open-stitched seam is made by two distinct processes: first, in the form and in the same manner as the plain seam; secondly, by stitching tape over the seam previously formed. A special machine is used for this purpose. The tape is fed by a machine which has twin needles and also makes a row of stitches each side of the original seam. This operation adds to the appearance and strength of the seam and takes a considerable amount of tension from the centre of the seam when subjected to any great strain.

The welt seam is made by stitching a narrow strip of leather or fabric in between the two parts to be seamed, and, after turning, the strip, if of leather, is trimmed off, leaving a narrow bead in the centre. This is most often used as a back seam for heavy work when a back strap is not required, and makes a satisfactory seam if care is taken when stitching, but, at the same time, if a strip of tape were stitched down each side of the welt, greater strength would be obtained.

The over-seam is often referred to as a zigzag seam, on account of the method adopted in stitching. Where parts are to be covered by a strap, or by another section, this seam is most satisfactory on account of the absence of the ridge usually associated with other seams. It is made in a very simple manner. The parts to be seamed are faced and stitched on a machine making a cross or zigzag stitch over the edge. As very little tension is applied to the thread, it allows the edges to come flush together when opened out, thus presenting a perfectly flat seam.

French seams are used on fabrics, often as a back seam on a lining. After being closed, the seam is opened out and rubbed down, when a row of stitching is placed down the left side of the centre seam, adding to the appearance and increasing the strength.

Seams of every description either require rubbing down or hammering. For both purposes machines are used. Plain or similar seams should not be hammered, but rubbed, otherwise they will be liable to burst open. (Fig. 48.) Lap or over-seams should be hammered; if rubbed, the friction will damage the stitches. A power hammer is used for this purpose, and the pressure is easily regulated to suit the substance of the material.

Methods of Closing. Many methods may be employed in closing the uppers. Those in general use may be classified as: (1) on the flat; (2) on the round or on the block; (3) held together; (4) combinations of 1 and 3 or 2 and 3. The fitting together of many parts, especially in the first two methods, depends upon the use of adhesives. The adhesive may be made from the flour of cereals, dextrine, rubber, or soap. A quick-drying adhesive is advisable; hence, the solvent used is of great importance.

Flour pastes of several kinds are commonly employed. The solvent in this instance is water, which evaporates very slowly. All pastes made from the flour of cereals have a serious defect; they dry hard and brittle by the evaporation of moisture. Unless specially prepared they do not keep their paste-like condition for any length of time. Evaporation of moisture causes decomposition, and if allowed to stand in a damp or dark place the paste will soon putrefy and become mouldy. Mould is caused by the action of bacteria in the air which settle

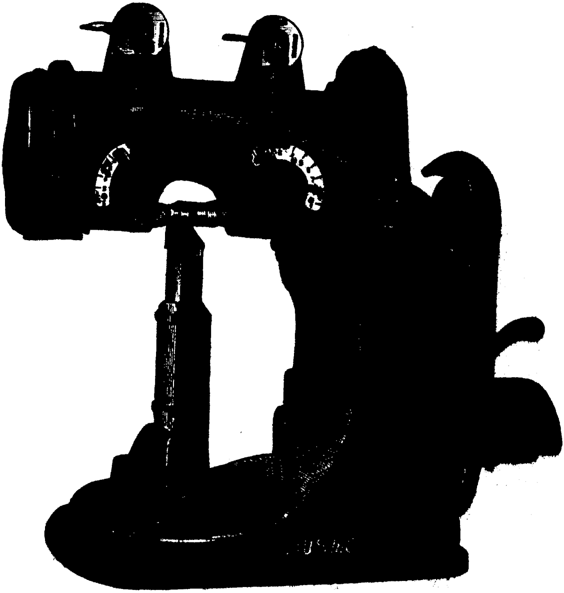


FIG. 48

"RAPID" SEAM-RUBBING MACHINE

in the paste, and in conjunction with certain elements, such as nitrogen, carbon, hydrogen, etc., breed fungi. The addition of preservatives, such as oil of cloves, carbolic acid, etc., is recommended, but even then such pastes are not very satisfactory. Other disadvantages must also be taken into consideration; they encourage vermin, and contract the face of the upper. Dextrine is a powerful adhesive, soluble in water, and although not attractive to vermin, it dries hard and contracts the face of the leather. The addition of glycerine will prevent brittleness, but unless care is taken, it will also detract from the adhesive properties of the solution. Rubber, in the form of cement, is undoubtedly the best adhesive to use. It is relatively expensive, although much of the expense could be avoided by using cementing devices or machines. Many agents are used for dissolving the rubber, such as petroleum ether, benzol, naphtha, and toluol. In use it is clean, powerful, vermin-proof, and whilst always drying flexible, does not contract the face of the leather. The character of the solvent ensures rapid evaporation, consequently very little time is lost waiting for drying. Soap is useful under certain circumstances. It may be used for delicate fabrics and on very light leathers. A good yellow soap is to be preferred and should be used by rubbing on where required. A paste made from tapioca is often recommended. This would be less expensive than rubber cement and would dry fairly flexible; at the same time, preservatives would be necessary if it were made in any great quantity.

Many special adhesive preparations are on the market; they answer a useful purpose, although the defects common to many adhesives are present.

Fitting. Where uppers are to be fixed or fitted previous to machining, the various processes may be done on the flat or on a block which is made to resemble the last or pattern. The flat method is rapid, but, as the name implies, is done on a flat plane. The flat fitted upper is also more difficult to last up, and the curves of the pattern are often distorted. At the same time, for certain types of shoe uppers, the method proves satisfactory, if due care is taken in fitting the lining. Block-fitted uppers are better in shape, the curves of the pattern are retained, and the linings fit as intended. A brief description of this method will not be out of place in view of the fact that it is often used in combination with another method.

After the lining is made it is placed on the block. The back, or quarters, are then seamed and afterwards fitted on to the linings still on the block. When the adhesive is dry they are removed from the block and stitched round. The parts are now replaced upon the block and have the vamp fitted on. The machining is then completed.

The held-together method is the most modern and is suitable for all ordinary designs and for most leathers, excepting, perhaps, very light, stretchy materials. By this method, no adhesive is required, all the fitting necessary being done by the machinist. The adoption of the held-together system involves the use of special machinery to obtain the best results, and the Singer Sewing Machine Co., Ltd. have invented machines suitable for every distinct operation. Probably a large proportion of the work produced is closed by this method, and the following description of closing a particular type of upper will convey an idea of the number and order of processes involved. In a modern factory, the work is carried through the department upon what is known as the team system; the machines are placed in groups, each group being used for one operation only, and the work travels forward as each portion is dealt with.

Order of Processes. Taking a woman's whole golosh, bagged top, glacé lace upper, for our example, the first process is to seam up the back of the lining. Machines used for this purpose are fitted with a gauge for regulating the seam allowance, and are capable of making 3,500 stitches a minute.

The second process is to tape the seam just made, or both may be done simultaneously on one machine. Top bands are next run on to the linings, the inside facings then being stitched on. Assuming no facing row is required, the legs would be closed up the back, preferably by a "zig-zag" machine, up to where the back strap terminates; thence as a plain seam for the remaining portion up to the top.

The linings, as fitted, are now run on to the top of legs. Stitching machines used for this purpose are fitted with trimmers for paring away surplus material behind the line of stitching. The top is next turned over, bringing the linings to the inside; the top seam is rubbed, and bagged over on a special machine used for that purpose. In this condition the linings should fit the legs when pulled out at the front; the whole is fixed by the next process in running round. This consists of stitching close to the edge of the legs and inside facings all round from corner to corner. In this class of work the front edge of the legs would be folded, and an ordinary vertical trimming attachment would cut the bead of the folded edge; under-trimmers are, therefore, employed on machines used for running round. When not required, the attachment may be put out of action, and the machine would then stitch without paring.

The next process would be to eyelet the upper. There are many machines used for this purpose; some punch and eyelet both sides together. The eyelets are placed in a hopper situated at the side or top of the machine, and are fed down a raceway; a punch piece perforates the material, into which the eyelet is inserted and clenched.

Linings are now closed at the toe end, preferably by a lap seam, and the tongue is tacked in. The toe-ends of the legs are next brought together and fixed with a bar tack thread, which prevents the front edges gaping when the golosh is fixed.

In factories where a combination of held-together and block-fitting is adopted, the uppers as now prepared would be placed upon the blocks and have a tack put in the toe end of the lining.

During the progress of the foregoing operations, another set of operatives are busy preparing the goloshes. First the toe case, if required, is stitched on to the overlap, or may be combined with the next process of stitching on toe-caps. Special machines, making two, three, or four rows of stitching, are used for this operation. Side linings should now be tacked on to the bottom of the golosh and the jockey strap seamed on and silked. The prepared golosh is now ready for the attaching to the upper portion, and, whether held on or cemented into position, similar machines are used for the purpose of stitching, being known by the description of "Post" or "Cylinder."

Several minor processes, such as removing or tying loose threads, are necessary, and although not absolutely required, a slight hammering off will add to the appearance of the upper, which is then laced or tied over, ready for lasting by a machine known as the "Ensign Lacer."

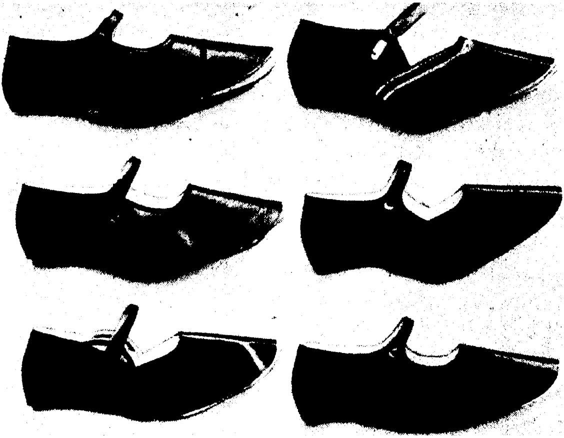
Bar Shoe. One method of closing a bar shoe upper by the held-together system would be as follows. Assuming all the parts have been previously prepared, the bar lining would be stitched on to the lining, afterwards closing the lining at the back. The seam at the front of the lining would next be closed and all the seams rubbed flat. Next, the vamp lining is stitched on to the back lining. The back seam of the quarters is now closed with a suitable seam, after which the vamps are attached to the quarters. Linings and outsides are now complete, and the linings are placed inside in their proper position, with the back seams level. A machine which trims off the lining as the stitching proceeds is used for the next operation.

Commencing at the button side, near the strap, the upper is machined round, all surplus lining being trimmed off at the same time. Button-holing and button sewing, which are done by special machines, complete the process.

Effect of Design. With uppers of a different design, some modification in the order of processes would be required. It is advisable to join the various sections together, as far as possible, when the parts can be machined conveniently. For example, on some classes of work, fancy stitching or a facing row is required, This should be done when the parts can be machined flat. Again, some types of ladies' shoes and men's shoes have a curved golosh as a part of the back quarter, and this would be attached before back seaming.

Vamps also have toe-caps, and these are attached with the vamp in a flat position. The method adopted in stitching the vamp must also be taken into consideration. In some cases it is preferred to put the vamp on without the stitches going through the lining. To do this, the lining must be tucked up beforehand. Vamp seams are certainly stronger for being vamped through, although there is the danger of bad-fitting linings; on the other hand, when they are not stitched through, the uppers may be cut slightly less in length to counteract the tendency to stretch. (Fig. 49.)

Stitch Formation. The formation of the stitches made by the different types of machines used in closing is of two kinds, lock-stitch and chain-stitch. Each type has its good points, but there is a considerable difference of opinion regarding the relative merits of the two. Greater speed may be obtained with chain-stitch machines; the chain formation lends itself to flexibility, but the ends of the thread should be fastened or covered over if absolute security is desired. On light, stretchy leather, this seems to be the most natural type to adopt on account of its flexibility, yet the inherent defect of such seams detracts from their general usage. When used for heavy or medium leather, there is a decided objection to it; relatively stout thread would have to be used and the chain formation would be so prominent that it would



(*Courtesy of the Singer Sewing Machine Co., Ltd.*)

FIG. 49

SIX BAR SHOE UPPERS

leave a ridge all round the seam. Seams made by lockstitch machines have greater solidity and are more uniform. To obtain the best result, both the top and bottom threads should be of the same substance; the value of a good, strong, stitching material is often reduced by the use of a poor, weak thread in the shuttle.

Stitching Materials. Silk, cotton, and linen threads are utilized as material for upper-stitching purposes. The strands, or fibres, must be as long as possible and should not be over-twisted. Threads may be twisted with a right and reverse twist, and, as a general rule, the reverse twist is used. For shuttle threads the direction of twist is not important; either will do. The different substances are known by numbers, the higher numbers representing the finer threads; the size is selected according to the class of work and the size of the needle.

Characteristics vary, and the threads should be selected with reference to their probable use. For practical purposes, the chief features to consider are: (1) smoothness; (2) power of resistance to friction; (3) breaking or tensile strength.

Silk threads have the greatest tensile strength and elasticity, but as they will not withstand any great amount of abrasive friction, their utility, apart from appearance, is limited. Colour also affects the strength and increases the weight of the silk, especially when finished black or with brilliant shades. When a silk thread is used, it is advisable to have another material for the shuttle thread; cotton or linen threads may be used for this purpose.

Cotton has a smooth surface, is brittle, and not elastic; on account of its smoothness it has great power to resist friction, and for that reason is very much used when tensile strength is a secondary consideration. During the last few years the finishing and glazing of cotton threads has been greatly improved, and in addition to lowness of cost, this probably accounts for their popularity as a closing agent.

Linen thread is rather harsh in nature, but strong, and when run through a wax containing a good proportion of grease, is suitable for heavy work.

The custom of buying threads ready waxed is not recommended; it would be much better to run the threads through the lubricant as required for use. After being waxed—unless the spools are kept in an air-tight box—the thread soon deteriorates, and much of the tensile strength is lost.

The improvement noted in the finish of cotton also applies to linen threads, and whereas linen, at one time, was not considered suitable for fine work, the appearance and lustre have so much improved that it is now quite a satisfactory stitching agent.

The Needle. The selection of suitable needles for use in sewing machines is important. The thread should pass through the needle-eye without fraying, but not too easily. If the eye is too large for the thread, miss-stitching will result; on the other hand, if the eye is too small for the thread, the thread will break.

Needles used for closing have two grooves—one long, the other short; the long groove is to protect the thread during its passage into the material, the short one is required to throw the loop which is made during the formation of a stitch. In selecting needles of different makes no reliance can be placed upon the size marked on the shank. The Singer Sewing Machine Co., Ltd., have, however, remedied this defect, so far as it relates to needles manufactured by them. For the purpose of standardization, needle sizes were altered some time ago, and it is now possible to obtain their needles in a regular standard number, from size 5 to size 35. The appearance of the stitch, in addition to the action of the machine, depends largely upon the needle.

Needle points are varied to suit different materials; for leather work, the point must be chisel-shaped, because, when pierced with a round point, leather has a tendency to close immediately. For sewing fabrics a round point is required. Generally speaking, needle points are classed as: (1) cloth point, (2) leather point. The cloth point is always round, but leather points are cut in various directions in relation to the eye of the needle. Each point, therefore, produces a different effect in the appearance of the stitch. As there are at least seventeen variations in the point of the needle as manufactured by the above-mentioned firm, a brief description of a few selected points will suffice.

What is known as a twist point punctures the leather from right to left of the line of stitching and produces a sunk diagonal stitch. The reverse twist point is opposite to the twist point, puncturing from left to right, and producing a slightly sunk diagonal stitch.

A wedge point makes a rectangular cut, and produces a flat, straight stitch; on the other hand, a cross point, which is the opposite of the wedge point, makes a rectangular cut, and produces a well-sunk, straight stitch. The latter type is suitable for heavy leathers, the wedge point for very light leathers, and the two first-named for light to medium leathers.

CHAPTER VIII

BOTTOM STOCK CUTTING AND PREPARATION

BEFORE attempting to describe the methods adopted in the production of the many sections composing the bottom of boots, it is advisable to have some knowledge of the characteristics of the chief leathers used and the requirements of the component parts.

Character. Bottoming leathers vary in character, weight, and colour; the first two features named are of the utmost importance. Sometimes colour will influence the buyer, although there is no reason why it should. To obtain a good colour, tanners often resort to bleaching, with the result that such leathers are considerably improved in appearance but weakened in many other respects. Certain tannages originating from countries like the United States and Australia are identified by their particular colour; British leather also has its distinct colour.

Origin of the Hide. Hides used for sole-leather are the skins of large, full-grown animals. As a rule they are obtained from cattle of the ox type and buffalo, although camel-hide, horse-hide, and pigskin are often used.

Most of the hides used are imported, and consequently they have to be preserved by various means. The method of preserving has its effect upon the finished product to a certain extent. Roughly speaking, hides that are used for making sole-leather may be classed as: (1) "green," or market hides; (2) "dried" hides; (3) drysalted hides; (4) wetsalted hides.

The "green" hide is one that reaches the tannery in a fresh state, within a few days of the animal being slaughtered. As a rule, no preservative is necessary for this class, although in very hot weather a slight sprinkling of salt is often used.

"Dried" hides come chiefly from South America, South Africa, and China. As the name implies, they are dried, and when dry they are very hard. The sun is utilized for drying purposes, and the hides are usually suspended with the hair outside. If dried too rapidly they become case-hardened, whilst the centre portion decomposes; such defects are almost impossible to detect until the manufacturing processes are well on the way.

Both the drysalting and wetsalting methods of preservation are used where salt is plentiful, and hides treated in such a manner are to be preferred to those dried in the sun. "Green" or fresh hides are naturally the best because very little time elapses before they are ready for the first stage towards their conversion into leather. Even so, most hides have certain defects, many from foreign countries being branded on the butt, one side or the other, and often brands may be found on both sides. Another defect is due to warble holes, which are caused by the maggot of the "warble fly." Usually the holes are found at each side of the back-bone in the best part of the hide, and they necessarily affect the usefulness of the finished product. Probably the greatest defect in our "green" or market hide is flesh cuts, which are due to careless flaying; many of the cuts are deep, and leather manufactured from badly-flayed hides is not so valuable as that produced from hides clear of flesh cuts.

Before the hides can be converted into leather many preparatory processes are essential. A section of hide as it comes off the animal is comprised of four layers: (1) the hair; (2) the epidermis, or outer skin; (3) the dermis, or true skin; (4) loose flesh and fatty matter. The first, second, and fourth must be removed, seeing that it is only the dermis that should be converted into leather. We say "should" because often too much loose flesh is left on; this adds weight to the leather, and has to be removed by the shoemaker. It is not within our province to deal with leather manufacture here, although the methods adopted in unhairing the hides have a considerable effect upon the finished article.

What concerns us more seriously is the methods adopted in rounding or dividing the hide.

Division of the Hide. Various countries have different methods of dividing the hide, and the method of division has an important influence upon the use to which such leather may be put. The usual method of division adopted in this country is to cut the hide into sections previous to tanning. The divisions are known as: (1) the butt; (2) the shoulder; (3) the bellies; (4) the cheeks. After tanning, the butt is often cut down the back-bone, producing what is known as a pair of bends. A bend is therefore half a butt. Unfortunately, there is no recognized standard with regard to the width of the bellies, the length of the shoulder, or the length of the butt. The stoutest and most valuable part of the leather is in the butt, and where the hide is rounded with wide bellies and a long shoulder, the butt when finished is more valuable because it is comprised of prime leather. It must be patent that when narrow bellies and short shoulders are rounded out, the butt contains some proportion of material common to those sections and is therefore not so valuable; neither can all the leather be used for the purpose for which the butt is intended.

In America the hides are cut straight down the centre, and no further division is made until the leather is tanned. This is put upon the market as sides. For the convenience of the British market, the tanned sides are often divided. For general purposes, it is advisable to use the former method of division. Each division can then be tanned with extracts or agents of suitable strength, and the divisions can be made use of for many purposes. When the whole side is tanned together, the lighter parts, or offal, as they are sometimes termed, are over-tanned, and even if the agent used would produce leather of general utility, the effect of tanning could not be the same on different parts of the side.

Foreign leather, with perhaps a few exceptions, cannot be so extensively used on different classes of work and for so many purposes as the home product, although much of the leather imported can be utilized for limited and definite purposes, according to the tannage.

The characteristics of various leathers are national; the fundamental difference between them is due to several causes, chiefly the method of unhairing the hides and the tanning agent used.

Classification. Roughly speaking, suitable bottoming leathers may be classified as American, Australian, and British. The real solid, dark-red American leather is now almost a thing of the past, owing to the gradual extinction of the hemlock. Consequently, the colour and character of American sole-leather varies according to the nature of the extracts used. What is known as Union leather has a very much lighter colour, and being mellow in character is suitable for most classes of light work. As American leather is tanned in the side, very great care must be taken in the selection, if the shoulders and bellies are required for general use.

The shoulder and belly of such leather is not always suitable for insoles or stiffeners, although on some classes of work an attempt is made to use it for such purposes. Generally, the best part is used to cut outsoles for ordinary machine-made goods, other parts being used for middle-soles, heel lifts, and top pieces.

What is known as Union leather has a colour similar to Australian, and, being of a mellow character, can be used for most classes of light work.

Australian leather is of a pink colour, and, in character, soft and light. It is of very little use for outsoles, except for goods intended for dry climates, but is suitable for soles of slippers and shoes not intended for outdoor wear. For all inside parts of boots or shoes, except heavy nailed work, such leather is satisfactory. Sometimes the bends from Australian sides are re-tanned in England, and the leather is then suitable for all ordinary purposes.

British sole-leather, when of good quality, is the best in the world and varies in colour from fawn, in pure oak-bark tanned leather, to brown of various shades in the case of other tannages. Naturally the character will vary according to the nature of the tanning agent used, but the method of unhairing usually adopted in this country enables the tanner to produce leather longer in the fibre and not so dense as some of the foreign tannages. Taking it all round, on account of the method of dividing the hides and the different treatment of the various sections so produced, British leather is the most suitable for all purposes of shoemaking.

Substitutes. Various substitutes are now used in the place of leather; in some cases, when used for toe cases or stiffeners, for example, they are satisfactory, but when used for soles or insoles, the substitute, which is composed of a proportion of rubber amongst other ingredients, is not so good. The wearing properties of such compositions cannot be denied; on the other hand, their detrimental effect in other ways must be considered. To maintain normal health, the foot must breathe, as it were; perspiration in the foot is continuous, although variable, and the perspiration, which is a waste product of the body, must be allowed to escape. Leather being porous, although reasonably waterproof, performs this function, whereas rubber substitutes do not. Hence, when the insole or sole of a shoe is composed of this non-porous material the perspiration cannot escape, with the result that the footwear is always damp, and not only that but the imprisoned perspiration adversely affects the upper leather by reducing its power to resist fatigue.

Use of the Parts. Soles and heel top pieces are cut from the butt or bend. Soles for slippers and turn-shoes, welts, insoles, middle-soles, and stiffeners may be cut from shoulders; insoles, middle-soles, stiffeners, and heel lifts from the belly.

The requirements of component parts will depend upon the purpose for which the boots are intended, and the character and nature of the method of attachment. Where flexibility is desired and a flexible attachment is used, obviously the bottom stock must be cut from light and flexible leather; on the other hand, where great solidity is required, the leather used must be solid in the fibre and thick in substance. As a general rule, parts of the bottom that have to withstand abrasive friction, such as soles and top pieces, must be cut from the best part of the hide, that is, from the bend or butt; parts that have to hold the seams, insoles, middles, etc., from the lighter and more flexible portion of the hides, such as the shoulder and belly. Other portions, stiffeners, toe cases, heel lifts, etc., are cut from the remaining parts.

A few exceptions have to be made to suit special cases. The character of stock required for various attachments will be described in a later chapter.

Before the leather can be put under the presses which are used for cutting, a certain amount of preparation is required.

Wetting. Where bends are used, they should be thoroughly soaked in clean water; if possible, in soft water. On account of the large proportion of lime in hard water, the impurities washed out of the leather are held in suspension to a greater extent, and there is more liability to stain the leather. Also, soft water penetrates more rapidly. Hard water may be softened by the addition of borax. Every effort should be made to keep the water as clean as possible, for if the contents of the tank are of the consistency of soup, staining cannot be avoided. The bends are next put into racks to drain, and afterwards into dark cupboards, where they are left until found to be mellow. The tempering stage should be carried out in the dark, or in a very subdued light. When leather is thoroughly wet through, a physical change takes place all over the surface, and there is not the same liability to stain during after processes. If dried in the sunlight, the effect would be disastrous.

When the leather is in a mellow condition, the next process is to roll or hammer it. Hammering has the effect of condensing the fibres, making the leather firm, and removing liability to stretch. At present this operation is not in general use on account of the absence of machines; hence the leather is put through heavy rollers.

Rolling. Rolling is only a substitute for hammering, and cannot condense the leather to the same extent, because the fibres are set at an angle by the action of rolling and have a tendency to resume their normal position when the leather begins to dry out. To obtain the best results, rollers should have a reversible action, and one cylinder should be made of brass or gun-metal to prevent staining. The leather, also, should be rolled through and back again in the opposite direction. All leather is not improved by rolling, and great care must be taken not to apply too much pressure on light-grained leathers, otherwise it would be impossible to get a satisfactory finish.

Methods of cutting bends vary in different localities. Some range or strip across previous to cutting out the soles; others cut direct. Ranges are convenient to use, but unless the sole shapes are fairly straight, and are cut without grafts, they are not economical.

Ranging. The best place from which to commence ranging will depend upon the use to which the fore-end of the bend can be put. Some manufacturers find it impossible to use the fore-end, because the substance or quality is not suitable for their work; others, probably doing a mixed class trade, could use it without difficulty. If the fore-end is satisfactory, stripping should commence from that end; on the other hand, where the fore-end cannot be used, stripping will commence at the butt end, the remaining portion being sold for other purposes. The bend is usually ranged across, and the width of the strip is cut equal to the size of the particular sole required.

It used to be the custom to cut ranges shorter than the soles, but this should not be done unless the leather is rolled after stripping. When the bends are rolled first, which is certainly advisable, there will be very little possibility of expansion. A large amount of discretion is required in cutting the strips. The presence of flaws and brands must be allowed for, otherwise they will interfere with economical cutting.

Ranges may be cut straight or waved, according to the style of sole to be cut. If through soles are used, and the shape is not twisted, a straight range will cut without much waste. But if soles with straight grafts are used and cut from the same shaped range, the amount of waste will be at least 10 per cent more than if the soles were cut through; yet, with a curved or waved range, the straight grafted soles could be cut satisfactorily. A straight range with a curved graft is likewise unsatisfactory, a curved range only being suitable. In normal times, it was not considered advisable to graft soles when cut from relatively cheap leathers, the extra labour entailed in cutting and attaching the graft being set against the saving in leather. With expensive leather, however, there is no doubt about the advisability of grafting. Leather for graft pieces can be purchased at less cost than bends, and as the graft is equal to about one-sixth the length of the sole, the extra labour entailed in grafting is more than balanced by the saving of prime leather. Very little skill is required in cutting up ranges, the soles being cut as close as possible across the range, starting from the side of the back-bone. It is usual to place the inside joint of the sole where the leather is slightly inferior in quality. This can hardly be considered sound practice, because the greatest pressure and wear is usually found to occur from the ball to the end of the large toe; hence it is advisable to place the outside joint near the back-bone edge. If ranges are cut from a butt, cutting would commence at each side of the back-bone.

Direct Cutting. In the largest and most modern factories, direct cutting is the method usually employed. There are many advantages of this method over the one just explained. When cut direct, no stripping is required, the whole bend being placed under the press and the soles cut out one after the other at a rapid rate, and small pieces of waste are avoided. Where many different toe shapes and fittings are used, soles are not always cut to the exact shape or fitting, but are cut out by what is termed a master shape; that is, one that may easily be converted to the shape required, by means of a block or pattern in conjunction with the use of a rounding machine. This is undoubtedly a great advantage, saving expense in knives and enabling the cutter to produce more work on account of the limited number of knives he has to use. Another advantage is that the edge of the cut stuff is always square when rounded. This is not always the case when cut with a knife, especially when the knife is made to cut one side only, the fellow sole being cut by turning over the leather. Master shapes also lend themselves to economical arrangement on the leather, more so than ordinary knife shapes, although most sole shapes readily allow of close cutting.

The best system to adopt in cutting is one that produces the most soles from a given area of leather. Much depends upon the shape of the soles and the manner in which they will work in. Sometimes a system is used which produces soles for one foot; in that case, bends of similar quality would have to be selected for the opposite foot; or, a system could be adopted of cutting a row for one foot, the next row taken out being cut to fellow those previously cut. The best arrangement for any particular shape may easily be determined by using methods similar to those explained in the chapter on clicking.

Bends vary in weight according to size, tannage, and substance. For ladies' work, the average weights used are from 6 to 8 lb. For men's work, they will vary from 8 to 12 lb. or more.

Sides will require somewhat different treatment, as the shoulder, belly, and cheeks are not rounded off when purchased; also the cutting will largely depend upon the type of press in use. If the press is sufficiently large, it is advisable, after tempering, to place the side under the press and cut out all the soles it is possible to produce. The remaining belly and shoulder will then be rolled and cut into what they are suitable for, by another cutter. When it is not convenient to adopt this method, the side is rounded by having the shoulder and belly removed, thus converting it into a bend, which is then cut up direct, or, if necessary, ranged. This method of treating sides is not satisfactory, because the rounder cannot possibly estimate the exact substance before rounding, and often removes leather suitable for soles. When butts are cut by the direct method, the first row of soles is taken straight up by the back-bone, and the two pieces thus produced are treated exactly the same as bends.

If the butts were very large it would hardly be convenient to cut direct, consequently there are two alternatives left, either to range across or convert into bends; in both instances, the prominence of the back-bone must be taken into consideration.

Treatment of the belly and shoulder will vary according to the class of leather and the purpose for which it is suitable. Shoulders often have the cheeks left on, although it is advisable to purchase them without such encumbrances. When the cheeks are off, the weight of the shoulders will vary from 3 to 10 lb. each, according to size and tannage. There is also considerable variation in substance, even in a single shoulder. English oak-tanned shoulders may be used for many purposes; the lightest would be suitable for stitched middle-soles, insoles, etc., and, when specially prepared with grease, they are used for welting; while shoulders of medium weight are used for soles intended for turn-shoes, slippers, and similar kinds of work, insoles for welted and screwed goods, and many other purposes. Heavy shoulders are often used for soles for cheap boots and shoes, as well as for middle-soles and insoles intended for men's heavy work. Very often there is a good proportion of leather only suitable for heel lifts. Stiffeners are also cut from shoulders where the substance is not too thick and the leather is firm and solid. Shoulders vary considerably in substance and quality, and systematic methods of cutting cannot always be used to advantage. The direct or ranged method may be adopted, but cutting should always commence at the back-bone in either case, and the patterns arranged so that inferior parts are not placed in the forepart of the soles or insoles produced.

Shoulders tanned with agents that have a tendency to produce harder leather will be found to be of less general use, although for distinct classes of trade they form a useful addition to available supplies.

Bellies of various tannages are also used. On account of the difference in the fibre, belly leather should not be used for soles or top pieces, not even for common work, and a manufacturer of any repute would not think of attempting to use it for such purposes. Insoles for various kinds of boots and shoes, stiffeners, middle-soles, toe cases, heel lifts, etc., are cut from bellies. The tannage and character of the belly will decide for what particular purpose it is suitable.

Machines of different types are used for ranging, cutting out, and rounding. The guillotine is the best machine for ranging under normal conditions. The leather is put under to gauge, when the knife descends and cuts the range through. If curved ranges are desired, this is the only suitable machine for the purpose. Another kind of machine used for the same purpose has a feeding arrangement for drawing the leather against a vertical knife. Any width of strip can be cut.

Presses. Presses chiefly used for cutting out bottom stock are known in the trade as "revolution" or

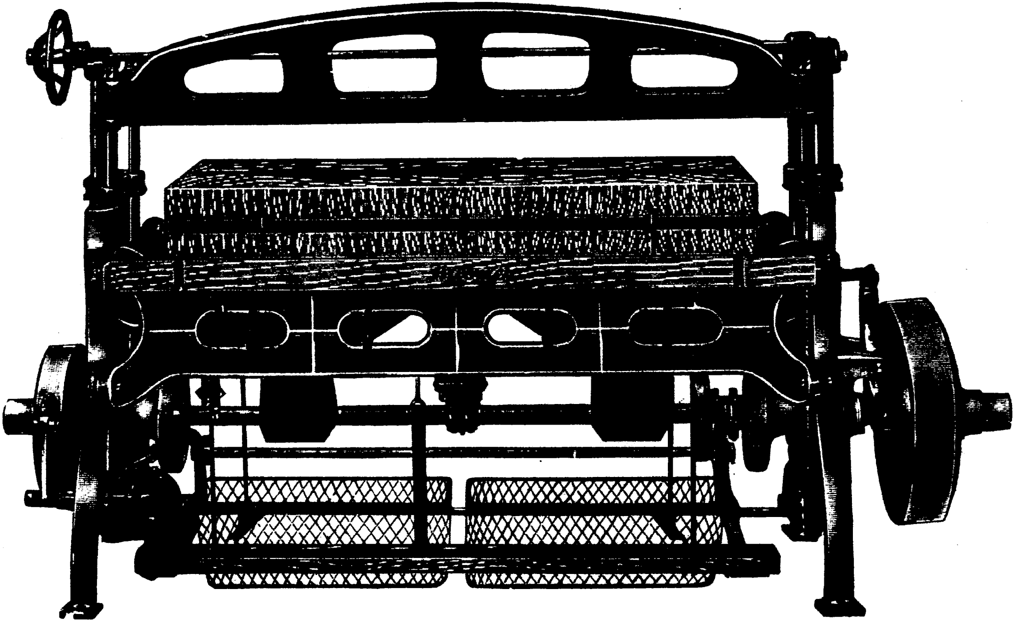


Fig. 50

REVOLUTION PRESS

"open end." The old type press with an eccentric motion used to be known as a box-press. The bed was enclosed by four posts in a very small area, which prevented the possibility of cutting any large piece of leather. The "revolution" press is built on somewhat similar lines, but the bed is formed by a cutting block several feet long. This enables the cutter to accommodate a whole bend or belly on the block, and the press is put into motion by means of a clutch action, with the depression of a treadle which extends the whole length of the machine. (Fig. 50.)

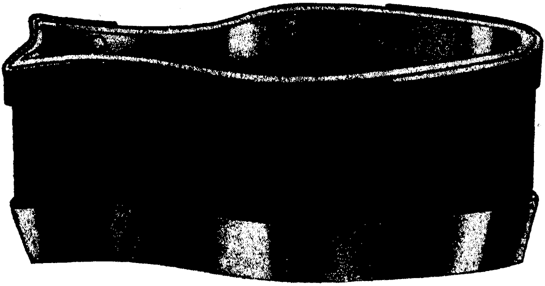


FIG. 51

PRESS KNIVE (DEEP)

When this type of machine was first introduced, it had a bad habit of repeating when least expected. This difficulty has now been obviated, and unless the treadle is depressed, the head of the machine remains stationary at its highest point. For cutting large and uneven pieces of leather, this type of press is undoubtedly the best, and is freely used when the direct method of cutting is adopted. The knives used on this machine are made deep, in order that the operator may keep his hands at the sides of the knives during the descent of the head. (Fig. 51.) Unlike the machine just described, the open end, or eccentric press, has a continuous motion, the buffer being adjustable to different heights of knives. Round wooden blocks are used to cut on, and it is necessary to clamp them with an iron band to prevent the wood bursting when too great pressure is put upon the knife. A machine similar in shape, but with a clutch action, is a more modern introduction; similar types smaller in size are also used. (Fig. 52.)

Rounding. When stock is cut by master shapes, rounding is necessary. One of the best machines for this purpose is known as the " Planet." Wood blocks of the desired shape are used, and the soles or insoles are clamped down. A vertical knife is made to travel round the block, cutting off all surplus leather.

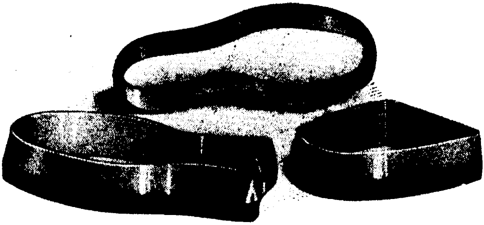


FIG. 52

PRESS KNIVES (SHALLOW)

Grading. After cutting, the stock must be sorted for substance and quality, according to the requirements of the particular factory. In many factories the substance of the sole, middle-sole, and other parts is ascertained by means of a gauge, and after considerable experience the sorter is tempted to depend too much upon his eye. Consequently, the substance of bottoms becomes very uneven when compared to stock gauged by mechanical means. Leaving out the question of expense, more satisfactory work is produced when the substance of the bottom is found to the smallest fraction. The best known machine used for this purpose is the

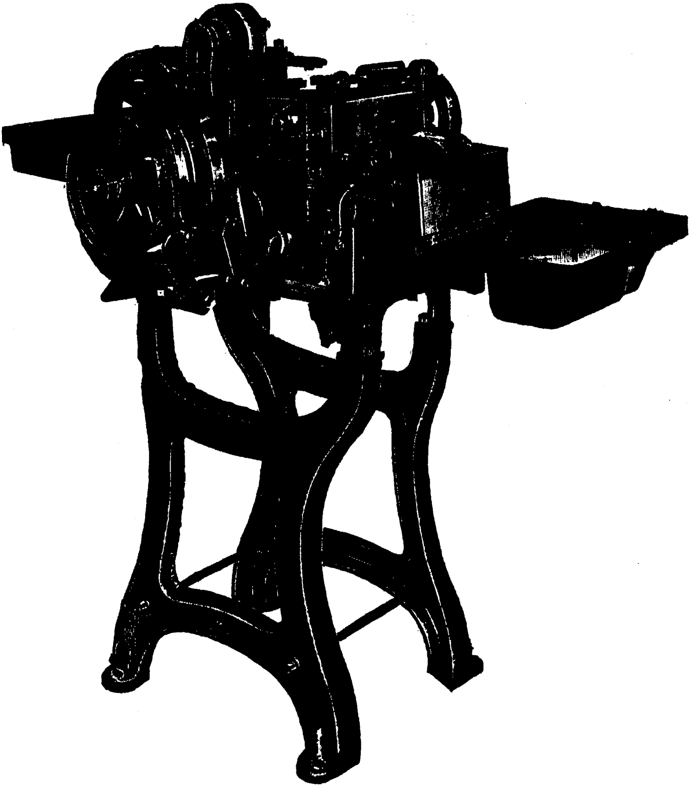


FIG. 53

"NICHOLS" EVENING AND GRADING MACHINE

"Nichols" evening and grading machine; it adjusts itself automatically to the greatest substance of the sole in the forepart, splits off surplus thickness, and stamps the gauge corresponding to the finishing iron on the seat of the sole. The machine is capable of grading either soles, insoles, or middle-soles to one-ninety-sixth part of an inch, and no man sorting by hand could even approach such accuracy. (Fig. 53.)

After being sorted into substances, the stock is sorted into several qualities, skill and experience being the only possible means of determining the quality of cut stuff.

Many firms buy their stiffeners ready cut and moulded; also the heels, but where these are produced in the factory, stiffeners should be gauged for substance and sorted for quality. In good class factories heel lifts also pass through the same operations, although in many cases too much is left to the compressing machine.

When the various parts have been sorted, they are often put into racks having partitions for different sizes, fittings, qualities, etc., and from these they are taken as required by the "fitter up," whose duty it is to assemble the soles, middle-soles, etc., according to the quality and substance of edge specified on the ticket.

Where the grading machine is used, edge substance is indicated by a number, as, No. 10, 11, or 12, the number denoting so many forty-eighths of an inch. For example, No. 12 would mean $\frac{1}{4}\frac{2}{8}$ths of an inch. Certain allowances must be made in fitting up to obtain any given substance in the finished edge. An amount equal to two forty-eighths or even four forty-eighths may often be required to make provision for finishing.

Preparation. Much of the success of modern machinery depends upon the proper preparation of the bottom stock. Preparation is often made in a separate department, although it may be a continuation of part of the bottom stock department. The operations necessary are numerous, and machinery is used to its fullest extent. We quote the following to give an indication of some of the processes involved, but not necessarily in the order they would take in the factory. Before stiffeners can be used, they require skiving on the flesh side in order to reduce the edges. The width of the skive varies, being deeper at the ends than at the top or bottom, where the depth of skive will be at least ½ in. This operation may be done by several types of machine, although the "Fortuna" is one of the best for the purpose. In the majority of factories moulded stiffeners are used; the "Young Counter Moulder" is largely employed for this purpose. If leather is used, the stiffeners are moulded with the grain side outwards; if not moulded, the grain should be placed towards the foot, as the contraction of the grain will have a tendency to pull the stiffener inwards.

Many firms buy their stiffeners ready for use, but if the mould does not fit the last they would be better without them, as a satisfactory seat cannot be obtained with an improper mould. To get over this difficulty, many operators break the mould, rather an unnecessary operation, especially as partly moulded counters could be used to advantage.

Insoles intended for through-seamed boots are "feathered," that is, the edge at the sides is slightly bevelled to assist the upper to bed down and form a continuous curve. Special machines are used for the purpose.

Moulding of the insole is a necessity where modern machinery is employed. The mould used on the machine is made to coincide with the shape of the bottom of the last; this not only assists the boot to keep its shape when slipped from the last, but saves tacks in lasting, which are a considerable item, especially where royalty machines are used.

Half middle-soles have to be bevelled across the tread, or widest part, so as to enable the sole to conform to the shape of the last. The depth of the bevel must be made with regard to the contour of the bottom; a last designed to carry a high heel would have more depression in the waist and consequently the bevel would have to be made at an acute angle. On the other hand, lasts with a dead waist would require the bevel to be deep, otherwise the bottom could not be made the shape required. If soles have grafted seats, both the graft and the sole must be prepared, in order that the graft piece will fit properly.

When work is made sewn, or stitched, it is usual to cut a channel in the sole to cover the stitches. The depth and length of the channel will vary, the machine being adjustable for this reason. Blake-sewn work requires a deeper channel to cover the loops made by the formation of the stitch. It should be sufficiently long to enable the operator to sew without having to cant, or hold the work at an improper angle. The seam made should be vertical, but if the base of the channel will not come over the insole, the work must be tilted, with the result that a round bottom is produced, and unnecessary strain is put upon the seam in after processes. Sometimes it is not possible or advisable to channel soles for stitching; a groove is then made near the edge, which allows the stitches to sink and offers a certain amount of protection.

Assuming that all the component parts of the bottom are prepared for the particular class of work, they are next fixed to the sole. If the work is to be made Blake-sewn, the middle will be tacked or cemented to the sole and the shank-piece fixed in the waist. If riveted or screwed, the same method will apply, all the parts being fixed together, thus making a complete bottom, which is then moulded to the required shape.

After moulding, the edge is trimmed by machine to make it perfectly square. The channel is opened by throwing the lip back in order that it may not be damaged during attaching operations.

Heel-making is fast becoming a specialized trade In many instances it is found cheaper to sell the heel stuff and buy heels already made; but where heel-making is included in the operations of a boot factory, more consideration may be given to their quality, which is certainly not always a feature of bought heels.

CHAPTER IX

LASTING

LASTING is the name given to a series of operations that assist in attaching the upper to the insole, previous to the attachment of the bottom.

Strictly speaking, lasting may be said to comprise three distinct operations, namely, drafting, pleating, and tacking. All of these may be performed by hand labour, but in the majority of cases machinery is used to its fullest extent, although sometimes a combination of hand and machine work is utilized. Whether the operations are carried out by hand or machine, the result aimed at is the same. The object of lasting is to get the upper down to the last and fix it on to the insole, at the same time removing the superfluous expanding properties of the leather, so as to assist the boot to keep its shape during wear. We have already seen something of the nature of upper leather. The laster has to strain this flat, stretchy material to what is really a series of curves represented by prominent points and depressions on the last. Anyone, probably, could pull an upper over the insole and tack it down, but that is not lasting—far from it. The points on a last vary in prominence, and as soon as the upper is placed over it, the highest points naturally come into contact with the upper, leaving other portions a considerable distance from the wood. The laster has to strain these portions down to the last, leaving the higher parts to take care of themselves for the time being. Another thing we have to contend with is a decided difference between the line lengths of certain parts of the upper in comparison with the last.

For the sake of economy in cutting, and sometimes for the purpose of adding increased tension to the upper, some parts are cut with what is termed " spring." The effect of spring on a golosh is to lengthen the amount along the lasting edge and shorten the top or counter line. Thus a considerable amount of strain is required to get the short line length to the last, whereas the excess round the lasting edge must be pleated away carefully, so that the pleats do not show round the feather edge or outline of the last. The particular method by which the sectional parts of the pattern are cut will influence the mode of procedure in the first stages of lasting.

For machine lasting, it is usual to have the uppers cut as dead as possible to the actual line length of the last, when heavy and medium material is being used. If light, stretchy leathers are used, a considerable amount of latitude may be allowed; in fact, a certain amount of spring in the upper is desirable, otherwise sufficient tension cannot be employed, and the boot will soon lose its shape in wear, if not before leaving the factory.

Without going too deeply into the technical principles involved, a brief description of the first stage in lasting is necessary for a proper understanding of the subject.

The most popular machine methods are based upon hand principles. We therefore give an outline of the hand methods. We will assume the uppers have been prepared by the insertion of the stiffener at the back, between the lining and the outside, the toe case softened if made of leather, or gummed if a toe gum is preferred, and the insole tacked on to the bottom of the last. The last is now placed inside the upper and then on to a pivot or lasting jack.

Drafting. Drafting, the first stage of lasting, is next proceeded with. This consists of straining the upper, first, along the depressions of the last. The order in which the strains are taken at various points constitutes the difference between one method and another.

Dead Method. When uppers have been cut dead, the dead method of drafting should be used. Usually, the upper is first fixed at the seat in order to prevent the back seam going "askew." The first pull with the pincers, a moderate one, is then taken at the centre of the toe end, and the upper tacked down. The result of the first pull sets up a moderate tension along the sides of the upper from the counter to the toe. The next strains are taken at each side of the toe-cap, or in a corresponding position if without caps. It is usual to take the inside pull first, followed by the one outside. These strains assist the first pull, if taken in the proper direction, by adding increased tension along the sides. The inside of the seat is then strained and fixed, followed by a similar pull on the outside of the seat. Very great care must be taken here to avoid a direct pull across, more especially in dealing with shoes. The final strain at all draft points should be in a forward direction, with the strength fully uniform all round, if the objects of drafting are to be attained. The seat drafts are then followed by those at the joints; first, just behind the swell of the inside joint, and then in a similar position on the outside.

Hoisted Method. Another method of drafting, the "hoisted method," is often used, especially for uppers having a large amount of spring, and for lasts with exceptionally high toes. This method helps to overcome a great difficulty caused by the amount of depression found behind the toe. The essential difference between this and the dead method is, firstly, the relation of the seat of the upper to the bottom of the last, and secondly, the order of tacking. When commencing to draft by the hoisted method, care must be taken to see that the upper is down at least 1 in. towards the top of the last. The first pull is then taken at the toe end, followed by those at the sides of the toe. The fourth strain is now taken by drawing the upper into its correct position by sinking the seat at the back of the heel. The effect of this is to set up an increased tension from heel to toe and bring into practice the application of the mechanical principle of the wedge. It will be seen that the same effect does not result from the former method.

After clearing the lining around the seat, the stiffener is first strained from the back of the last, after which the inside and outside strains are taken at the seat position. The next strain is taken behind the inside joint, followed by the strain at the outside joint. Providing the strains have been properly taken to conform to the principles of lasting, we should have uniform contraction of the upper at the essential points. In this condition, it should be possible to remove the last, and yet the upper should retain the shape imparted to it.

Pleating. After drafting is complete, the remaining parts of the upper between the draft points are pleated and tacked down, the toe portion being completed last. A large amount of skill is required to pleat properly a toe or a seat. Pleating is commenced at the centre tack, working each side alternately, and the pleats should point outward towards the side of the toe or seat. When heavy upper leathers are used, it is often necessary to cut the toe end to assist the pleating. Where this is done, the cut should be made in the same direction as the pleat.

Tacking. There is no necessity for the laster to use an enormous quantity of tacks. Forty to fifty should be sufficient for men's machine-sewn goods, and for welted work fewer are required, as there is no necessity to last the waist that is to be sewn on a welting machine. The method of tacking will vary with different classes of work. Boots that are to be machine-sewn, riveted, etc., will require the tacks to be about ⅜ in. from the edge of the insole, while for machine-welted work, the tacks are driven into the bottom of a channel, which is made previous to lasting.

Before leaving this section, it might be advisable to point out the effect of the two distinct methods of drafting upon the appearance of the boot. The pattern-cutter designs his patterns with reference to the manner in which they will be drafted, but in most factories it often happens that a few uppers come tight. In order to get over the difficulty, the operator adopts the hoisted method for the tight uppers, a practice that should never be allowed, since the effect of one on the other is totally distinct.

Uppers that are intended for dead lasting have more back curve in the pattern, and the leg is cut more forward than for hoisting; thus, if a few uppers are drafted by a method they are not cut for, the appearance of the made-up boots will be far from satisfactory when compared with the bulk.

Having briefly described some of the methods adopted for lasting work by hand, we leave several minor operations to be included in the following pages.

Machine methods of lasting are now used in most of the modern factories. Ordinary kinds of work, such as machine-sewn, riveted, screwed, etc., are often made in one factory. Others may specialize in welted and sewn and stitched work; others, again, in turn-shoes and *veldtschoens*. Where one kind only is made, the machinery required might be different, although the principal machines are capable of making most classes of goods. It would require too much space to describe fully the process of lasting all kinds of footwear; with many the actual operations are similar.

Even with the same class of work, variations in the method of procedure may often be found, these being due to the use of different kinds or types of machinery, or to some local consideration. For instance, machine lasting may be carried out by two distinct types of machine: (*a*) The vertical or automatic pincer machine; (*b*) the bed or wiper machine. For speed and all ordinary conditions the former represents the type of machine most widely used.

The operations associated with the lasting department are worked upon what is known as the team system. Each operative thus becomes expert at the particular operation he performs. With few exceptions, he is seldom capable of working or understanding more than his one particular machine, and however desirable this may be for purposes of output, in the interests of the workers such methods are certainly not conducive to interesting employment. Yet it is the same in every department of the factory, and unless the operative cares to give up some of his spare time and attend a modern technical school where he is allowed to use machinery, there is very little chance, under our present industrial system, of any improvement in his outlook.

With ordinary machine-sewn or welted work, the first stage in the team commences with what are known as the assemblers. Here, the uppers meet the insoles and counters, and are generally dealt with by youths or boys. After the insoles have been tacked on to the last and the counters inserted in the uppers, the next operation will depend on the system employed. With the use of moulded counters, it has become the custom to use the dead method of lasting, and with some systems of working it is found convenient to tack the seat down first. This may be done by hand or machine.

Before dealing with the machine operations that correspond with those previously described, it will be interesting to note the development of the machines during the past forty years.

F. W. Roberts, F.B.S.I., writing in a paper recently issued by the Boot and Shoe Teachers' Association, remarks—

> Although many attempts had been made and many ingenious devices had been adopted, it was not until about the year 1890 that lasting machines were brought into general use. The early machines followed certain well-defined lines of development, which we shall more readily understand if we turn back again for another brief look at our hand laster. Hand lasting might be readily divided into two parts: (*a*) the work of locating and stretching the upper on the last, and (*b*) inserting the tack or fastener to hold the stretched upper. The first practicable machines did one or the other only of these two parts, and it was not until the lapse of some years that machines were introduced which were capable of doing both parts. As these early machines exemplified certain basic principles, and as these types still survive, although, of course, in much modified forms, we will briefly describe a typical specimen of each.
>
> *First the "Tacking Machines."* A good example is the "Boston Tacker" or "Boston Laster" so called. This machine succeeded an earlier type known as the "Magnetic Tacker." The essential parts of the mechanism were a jack upon which the shoe could be placed, and, in conjunction, suitable mechanism for driving the tack or fastener after the upper had been stretched by hand pincers. The stretching was invariably done by hand, and in this particular the work done by the aid of this type of machine was theoretically equal to hand lasting; the machine doing merely subsidiary work of driving the fastener. Actually the work never was quite so good as hand-work, because of the lack of solidity of the jack. The jack had to have such movements as would permit of every part of the bottom of the shoe being brought underneath the tack delivering nozzle, and was therefore so unstable that the use of one hand was almost essential for holding things firmly whilst the stretching was being done with the pincers held in the other hand. Upon light work, such as women's and children's shoes, it was capable of good results, but upon men's or boys' work, where greater strength was needed to strain the upper into shape, this type of machine was not

efficient. Note, that in suitable circumstances, the operator was able to exercise full discretion in the amount of straining to be given to any part of the upper or lining; in this sense the principle of using this machine in this way was very sound, but mechanical defects limited its usefulness. At a later period this type of machine was used very effectively as a "Puller Over."

Next the "Bed Lasting Machines" or "Wiper Lasting Machines." This type of machine accomplished its work by the aid of wiper plates, which, being shaped to fit the toe or heel of any particular last, wiped or forced the upper over the edge of the insole, moulding it firmly into shape until the tacks or other fasteners could be put in. The tacks were put in by hand or by some device distinctly separate from the main machine itself. Several attempts were made to apply pincers for use along the sides of the shoe, but these were never commercially successful. As a lasting machine it reached a high degree of efficiency, especially on heavy uppers or upon welted shoes, for which it is particularly suitable. This type of machine is still in use to-day, and in its own particular sphere it is still probably the best lasting machine we have.

Following upon these came *the "Consolidated" type* of lasting machine. Here we have a machine which both stretches the upper and drives the fastener. As this is the machine mostly used to-day, we will describe it more fully. The best conception of the machine can be visualized by watching closely the movements of a hand-laster when lasting a shoe, and then imagining these movements to be copied precisely and accurately by mechanical devices. We have a single pair of pincers which have movements upward and downward, forward and backward, from side to side, and, in addition, they can twist or rotate on their axis. Working in conjunction with the pincers is a mechanical thumb or wiper, which serves exactly the same purpose as the thumb of the hand laster, holding the upper securely over the feather edge after the pincers are released and until the fastener shall have secured it. Here is a point which should be especially noted. *At all times when the pincers are stretching the upper their movements are controlled by springs or other adjustable yielding devices or mechanism.* Theoretically, then, we should be able so to apportion the strength of the various movements that any upper, from the lightest to the heaviest, should receive just that degree of straining necessary for perfect lasting. Actually there are certain imperfections which seem to be inseparable from mechanical devices when applied to variable conditions. For a single pull, the theoretical adjustment of the machine may be perfect, but for a series of pulls, such as are required in lasting a single upper, many varying degrees of strength may be required. But even this difficulty is provided for to some extent by the ingenious way in which the work is presented to the machine.

The shoe is not presented upon a rigid support, but is held in the hands of the operator. If then the machine is adjusted for the maximum strength required for the run of the work, anything from the absolute maximum to the minimum of no pull at all can be imparted. If the shoe is held firmly the full force of the machine becomes operative; if the shoe is held loosely in varying degrees, then any part or all of the force of the pull may be rendered null and void.

Here then is an indication of the way in which the machine should be adjusted for use. Set the strengths of the various pulls to the maximum required by the work in hand; where full strains are required hold the shoe rigid, permitting the machine to exert its full power; where less power is required, adjust by letting the shoe be carried by the machine movement without resistance for the whole or part of the pull. It is the impossibility of getting perfect harmony between the machine movements and the yielding hold or resistance of the shoe in the hands of the operator which limits the perfection of the work. Other mechanical imperfections are, that whereas by hand we may give several pulls before driving a fastener, the machine must deliver a tack for every pull made, and we often in this way get more tacks in a shoe than is necessary or desirable. Again, whereas in hand lasting we are able to impart strains to lining or outside, etc., separately, by the machine all must be taken together and receive the same extent of straining.

Both the "Bed Laster" and the "Consolidated Laster" require that in general the upper shall be pulled over or drafted first. The success of the "Consolidated" machine soon led to the development of a "Pulling-Over Machine" along the same lines, but, of course, with more pincers and more tack drivers. About the year 1900 such a machine was successfully applied, and since that time such strides have been made that machines have almost entirely taken the place of hand work for pulling over.

At first three pairs of pincers only were used, one at the end of the toe and one at either side of the cap. Later, five or more pairs of pincers have been applied with varying degrees of success.

A fundamental difficulty in the early days of the machine was of a similar nature to that which has been mentioned in the case of the "Consolidated Laster," the necessity for varying the strengths of the pulls. The very ingenious way in which this has been overcome in the case of the Puller Over requires special mention. With the "Consolidated Laster" the pulls of the machine were adjusted to a maximum, anything less being obtained by the yielding hold of the shoe in the hands of the operator. With the "Puller Over" the shoe is not held in the hands of the operator, and, therefore, this means of obviating possible damage is not available, although the need for variable strength of pull is just the same. This is how the difficulty is

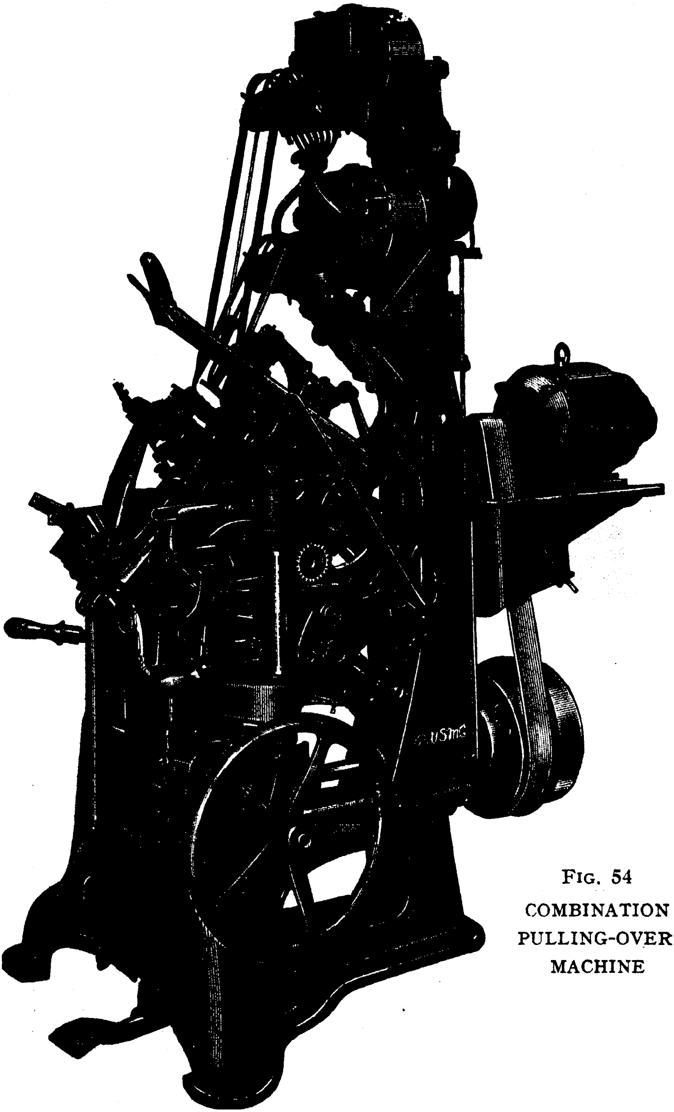


FIG. 54
COMBINATION
PULLING-OVER
MACHINE

met: In drafting an upper it is always necessary after it has been drawn down to the last to adjust and place the lines so as to give effect to the design. In machine work this is done by making the machine do its work in two stages. The machine stops when the upper has been drawn down to the last, affording the operator opportunity to settle the lines correctly by means of the devices provided. When this is done the machine is again set in motion and the tacks are driven, completing the operation.

Pulling Over. Assuming the seat is tacked, the work is next passed on to the pulling-over machine. The object is to draft the upper, but as up to the present no machine has been invented to do the work completely, the machine only pulls over and tacks at the end of the toe, each side of the toe, and sometimes in between the cap position and the joints. If other draft points are required, they must be tacked by the lasting machine operator, or be done by hand.

A well-known machine used for pulling over is illustrated in Fig. 54. Another type of machine, known as the "Rex," is also used. The work done by the machine is similar, but the position the upper occupies in the machine is different. In the machine under review, both machine-sewn and welted work may be dealt with. The machine has two motions, the first of which strains and pulls the upper down to the last, whilst the second releases the upper and drives the tacks in five places. The tacks are placed in a hopper at the top of the machine; from thence they run into races, from which they are separated and dropped into pockets.

Seat-Lasting. By utilizing the latest modern invention, the seat may now be lasted in one operation. The heel seat lasting machine (Fig. 55) is used for this purpose. The shoe is jacked in the machine and clamps hold the upper and counter close to the last. The upper is wiped over the heel seat with a gradual pushing motion and secured by fourteen to eighteen tacks being driven

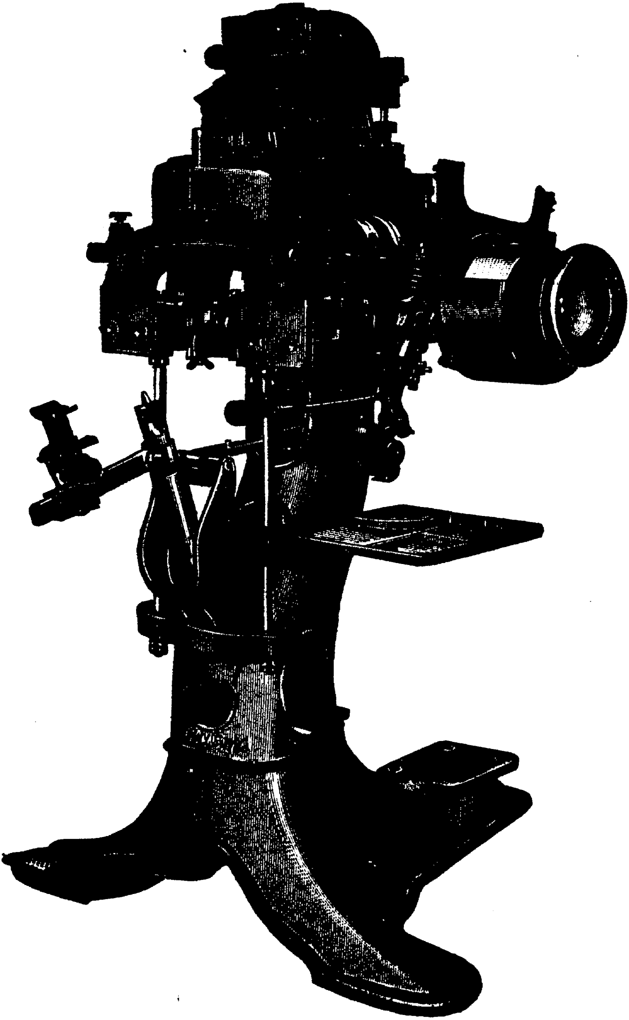


Fig. 55

SEAT-LASTING MACHINE

by the machine simultaneously. The effect is a perfectly formed seat, with uniform straining and uniform tacking. Without the use of this ingenious machine each of the tacks would have to be driven individually, and for each tack a separate pull or push would be required.

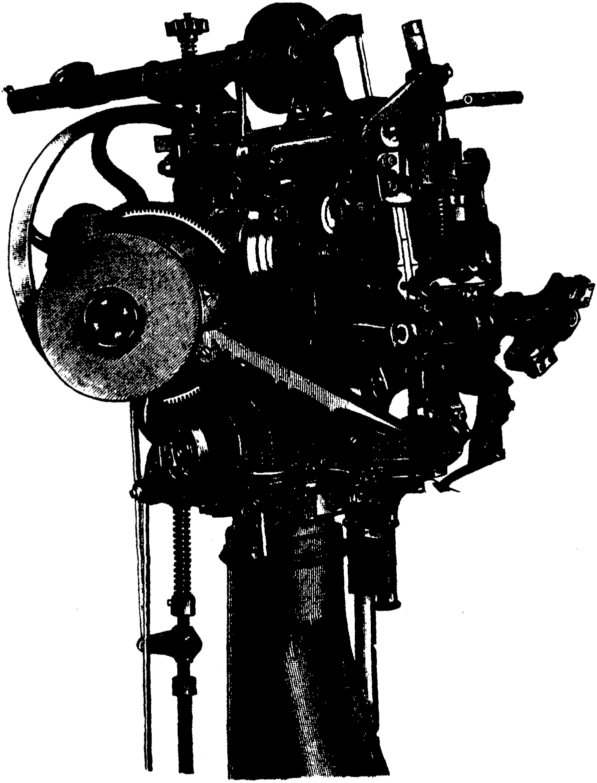


FIG. 56
CONSOLIDATED LASTING MACHINE

When the same principle is applied to the toe of the shoe, as no doubt it will be before long, then the operation of lasting will be very much simplified.

Machine Lasting. Following the pulling over and seat-lasting, the work is then passed on to the consolidated lasting machines. This class of machine is of the automatic pincer type, and practically repeats the hand method of lasting in the upper. A greater amount of strain is more regularly and evenly applied than is possible with hand lasting. By using this machine any method of drafting or pulling over may be utilized. (Fig. 56.) In lasting through seamed types of footwear, the consolidated machine not only pulls and pleats the upper over the last, but also feeds and drives the tacks, clenching the points on the insole at a regular distance from the edge of the last. The capacity of such machines is only limited, practically speaking, by the capacity of the operator.

For welted work, the same kind of lasting machine is used for the sides of the shoe, the tacks being driven into the channel of the insole in a slanting direction. As each tack is driven, a tack-bending device bends that part of the tack left standing aloft into a vertical position to prevent the tack from coming into contact with the welt during sewing.

It is preferable to last the toes of such work on a bed lasting machine, and in the event of not using the heel seat laster the seats would also be lasted by this machine. (Fig. 57.) It is usual to brace the toe end of welted work with fine wire. The wire is applied after the wipers of the machine have pushed the upper into the shoulder of the insole. With bed lasters the tacks are not driven by the machine itself, but by hand with automatic tackers. Bed lasting machines do not last the sides of footwear; hence the work must be completed on the consolidated machine. If preferred, a staple side laster may be used

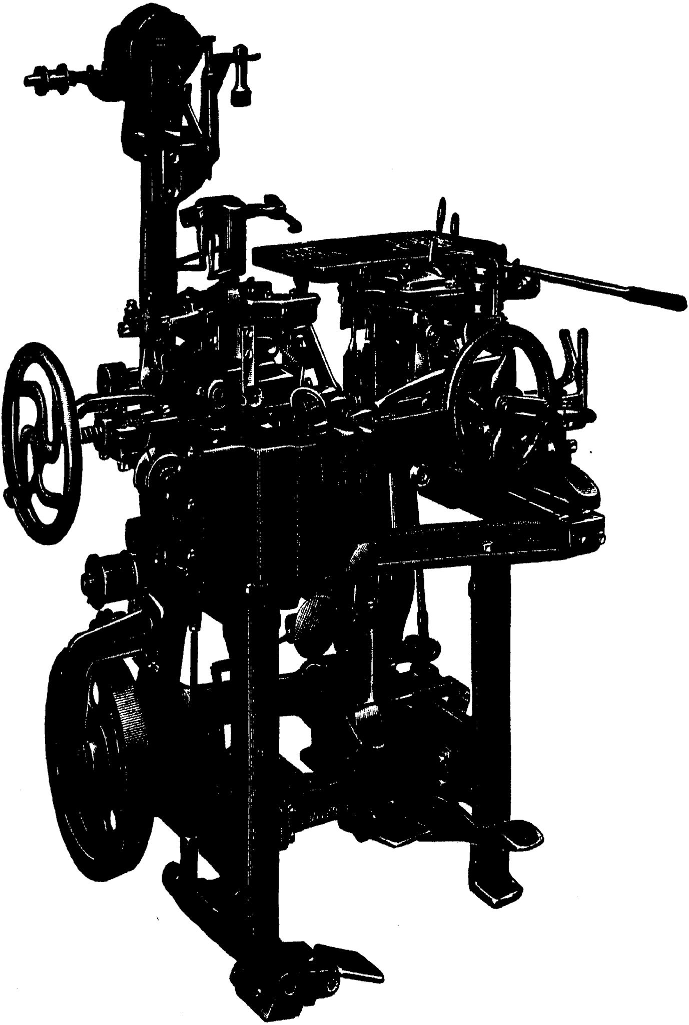


Fig. 57

BED-LASTING MACHINE

for this purpose. Where tacks are used, the tacks must be withdrawn after welt sewing. With the staple, however, there is no necessity for removal.

Another kind of footwear, known as *veldtschoens*, is made without the use of an insole, the upper being stitched directly to the sole. At the seat, to make a solid foundation for the heel, it is usual to insert a seat piece. The seat is then lasted and tacked in the ordinary way. The forepart of the upper may then be pulled down to the last by a special machine, after which the sole is tacked down; the actual lasting being carried out at the same time as the upper is stitched to the sole, by means of a pincer attachment fixed on to the stitching machine.

With this kind of work, very little strain is required to get the upper down, and draft, as understood in relation to lasting, is not a necessity; as a matter of fact, it is possible to make some types of *veldtschoens* without the use of a last, especially if no heel is required, as in the case of sandals. After completing the lasting of ordinary goods, the hand laster used to hammer thoroughly the bottom and sides, the operation being known as tapping up.

Pounding Up. Modern wood lasts, however, demand more gentle treatment, with the result that a machine known as a "pounder," or "knocker-up," is now used. This machine cuts or grinds away the bunched-up pleats at the toe end, afterwards consolidating the tacks, and also rubs the upper round the lasted edge. The effect is to cause the upper to lie snugly on the last and insole, and so reduce the cavity formed by the substance of the upper.

A level surface must be produced before the bottom can be attached, and this cavity is filled with various materials, adding still another operation, known as bottom-filling. The substance of the upper, the shape of the bottom of the last, and the method of making, will influence the amount of filling required.

Team System. Mention has already been made of the team system of working, and it will not be out of place to give one or two instances of how a team is worked in one department of a modern factory.

The quality and quantity of work required, in addition to machinery used, must influence any arrangement. On average class work, and without the aid of a pulling-over machine, four men, a boy, and a youth would be found sufficient for a consolidated team, doing about 1,000 pairs per week of machine-sewn goods. The quantity might be slightly under or over the amount named. That would depend chiefly upon the capabilities of the men, and the quality of the work produced. The boy would insert the stiffeners and pass the work on to the pullers-over. Three men could pull over the uppers at eight points and fix insoles, and the number of pairs could be increased if the uppers were pulled only at six points. The consolidated lasting operator is expected to keep pace with the team, but, of course, there is a limit to his capacity. The youth would attend to the pounding up.

The fundamental principle of arranging any team is to base the arrangement on the average capacity of the fastest machine. With the use of a pulling-over machine, a different arrangement would have to be made, and as the capacity is at once increased, the team must be arranged to suit the inclusion of the machine. It is supposed that this type of machine is equivalent to the output of six men, and if we base the team on this assumption, two boys would be required to insert stiffeners, two youths and a man (or three men) to assemble the stuff and sink the seats, a pull-over operator, two lasting machine operators, and a good operator for pounding up. The quantity of work produced by such a team would vary, but more than twice the amount of work could reasonably be expected when compared with the output previously mentioned.

In some factories, additional operations which are related to the bottoming department are often included in the lasting section. When the boot is pounded, the responsibility of the foreman should cease. The foreman in the next department is responsible for bottom-making, and if he had the supervision of bottom-filling and tacking on, any bad work due to faulty tacking could be more easily remedied. On the other hand, there are certain advantages in having the stuff temporarily attached in the lasting-room, as directly the stuff is on, the last can be slipped and returned to the starting point, whereas, if allowed to go into another department there might possibly be some delay in the return. However, as far as team arrangement is concerned, if it is more convenient to include the operations in the lasting department, the labour that would be added to the team would have to include the bottom filler, tacker, and a lad or lads for slipping the lasts out of the work.

Welted work is treated differently from that just explained, the lasts usually remaining in until the boots are finished. All the operations after lasting are carried out in the bottoming-room.

CHAPTER X

BOTTOMING

WHEN the work arrives from the lasting-room, the first stage towards making a bottom is to produce a flat surface for the sole to rest upon.

Filling. The surface produced by lasting over the upper will naturally vary with the substance of the materials used in the upper. Ordinary Blake-sewn and other through-seamed work produces a ridge round the insole equal to the substance of the upper. The bottom must, therefore, be filled, and a level surface produced. The shape of the bottom of the last will decide the amount and shape of the filling required. A last flat in the forepart would require a filling to fit in the depression formed by the edge of the upper; a round-bottomed last, being higher in the centre than at the sides, would only require filling in at the sides, and probably a very thin layer in the centre. Welted work always requires more than Blake-sewn, on account of the higher ridge made by the welt seam. It is a common practice in factories producing medium and common class work to fill only the space comprised by the forepart, that is, from the tread to the toe. Whether this is done to save material or labour, it is poor economy, as satisfactory work cannot be produced unless the bottom is filled from heel to toe. If the forepart only is filled, two-thirds of the length of the sole is resting in the centre on a different plane. Not only that, an unnatural depression is formed on the insole, directly over the centre of the heel, the effect of which is detrimental to the shape and comfort of the shoes during wear.

Materials Used. Materials used for filling are many, and include solid leather, tarred felt, sheet cork, ground cork and cement, ground leather waste and cement, leather scraps, and, alas, sometimes cardboard. For solid work, undoubtedly a solid leather filler is best, although the music produced is likely to be rather pronounced in dry weather! Felt is one of the materials most commonly used, and, if securely fixed by cement, it is better than leather for light footwear, being light in weight, waterproof, and flexible. Sheet cork is also an excellent filler, but it is used only for expensive work. Several proprietary mixtures, consisting of ground cork or leather and some paste-like material, are used. They are spread over the bottom with a knife and levelled off with a roller. One particular kind of filler must be heated before being used, and although it is claimed it will always remain solid, it seems probable that the warmth of the foot might cause it to move; therefore one that sets cold is preferable. Where leather scraps are used, they must be tacked in separately; even then, such filling must prove expensive and unsatisfactory.

It ought to be made a penal offence for anyone to use cardboard as a filler, no matter on what class of work. Cheap, common trash is bad for the wearer at the best of times; a good waterproof filler would certainly help to minimize some of the defects of shoes having low-grade bottoms.

Creaking. The question of creaking in footwear is one that has often been discussed, and the only sure way to prevent it is to coat all surfaces of leather coming into contact with one another with some material that will prevent friction, since that is the cause of the squeak. Cemented canvas, sheet rubber, or linen lining cemented on the surface will answer the purpose; and French chalk powdered on will sometimes act satisfactorily. We have seen blacklead recommended for the same purpose, but would advise anyone not to use it, on account of the habit it has of working through the insole. Of course, if good, black impressions of the feet are wanted to ornament the sheets, by all means use blacklead!

• **Methods of Attachment.** Many methods are used in attaching uppers to bottoms. The nature of the seam, the kind of attachment, and the character of the bottom stock, each have their influence upon the flexibility of the bottom produced. Thread, metal, wood, and adhesives are used, under various conditions, for making the seams; sometimes the seams are horizontal to the ground, but more often vertical seams are used. The method of attachment may be either direct or indirect, and in some cases a combination of both horizontal and vertical seams is used.

Each method of attachment has its distinct characteristic and should have some relation to the purpose for which it is intended. For instance, we should not expect a boot with a stuck-on sole to be suitable for agricultural purposes; neither should we attempt to rivet a sole on to a dancing shoe. Again, each distinct method of attachment possesses a certain degree of flexibility; hence, the bottom stock selected must conform to a well-defined specification. For very light footwear, the "stuck-on" or welded process produces a very flexible attachment. The soles in both instances are fixed by an adhesive; in the first case, rubber cement is often used, and in the second cellulose cement. After coating the bottom of the sole and the upper with the adhesive, the soles are placed in position. Pressure is then applied to the bottom by clamping on to pneumatic pads arranged in a machine to hold several pairs at one time.

Another flexible attachment is made by what is known as the "Spen welt" method. As no insole is necessary the amount of flexibility will depend upon the substance and character of the sole. A horizontal cut is made round the edge of the sole, about ½ in. deep, dividing the edge into two parts. The upper is then cemented in round the edge and the sole afterwards levelled down.

Probably the most flexible type of footwear is still a well-made turn-shoe. This is made with a single horizontal thread seam, the upper being directly attached to the sole. This kind of work is made inside out, afterwards being turned, re-lasted, and filled. The bottom stock used must naturally be flexible, otherwise it would be difficult to turn.

The *veldtschoen* is the next in order of flexibility, being made with a single vertical thread seam, and it is also a direct attachment, seeing that the upper is stitched on to the top of the sole. A strip of leather, called a rand, generally about three-sixteenths of an inch wide, is stitched at the same time on to the top of the upper and is easily seen round the edge of the sole. The effect is to add, apparently, more substance to the edge, and some makers take advantage of this to reduce the substance of the sole. As the rand is used to prevent the stitches pulling through, and to counteract the tendency of the upper to stretch, soles should not be reduced in substance on that account. This class of work does not contain an insole, and the method is frequently used for making children's footwear, as also for slippers for adults. When intended particularly for outside wear, the soles should be cut from good quality leather, a low grade *veldtschoen* being practically useless for children's wear. Many attempts have been made to produce a " veldt " that is easy to repair; any such method only helps to destroy the flexibility of the shoe, and the result is doubtful.

Nearly half of the boots and shoes made in this

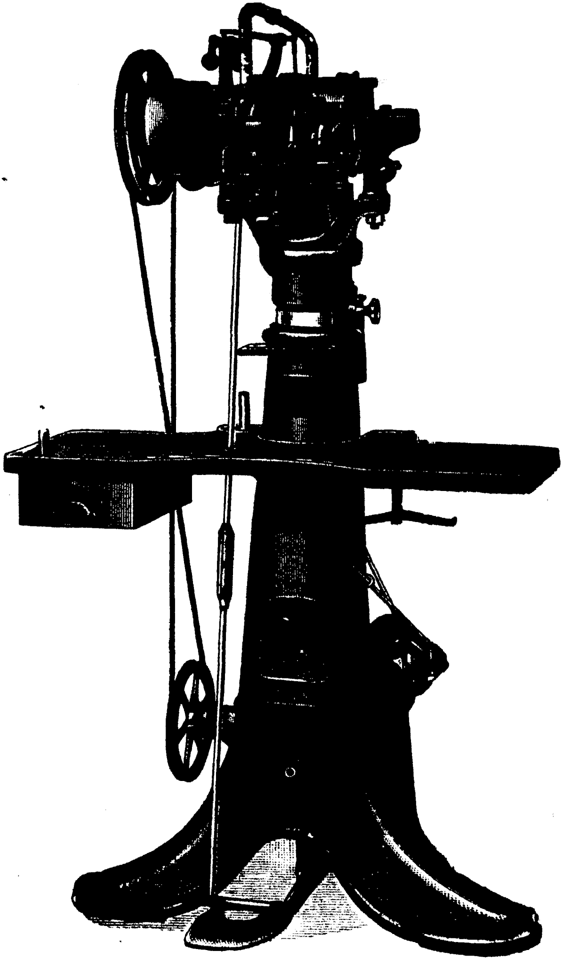


FIG. 58

WELT-SEWING MACHINE

country are made by the welted system. This produces a flexible type of footwear, although the degree of flexibility will depend upon the substance and character of the component parts. The attachment is indirect, the welt being sewn to the upper and insole and the sole stitched on to the welt, a combination of horizontal and vertical seams being used. The leather used for welted goods must be flexible, tough, and not too dense. In some cases what is termed a "gem" insole is used. This is a light leather insole covered with canvas and has many advantages over the solid leather insole, especially when weight and strength of the seam are a consideration. The gemmed insole is considered to be as strong, also, and it is certainly more flexible than solid leather. Welts are narrow strips of leather cut from a specially prepared curried shoulder. The apparent difference in the width of the welt may be regulated by the method of channelling the insole. For a wide welt, the base of the channel would be nearer to the edge of the insole, while for a narrow welt it would be taken further in. The insole is prepared previous to lasting. After lasting, the first important operation is welt-sewing. A chain-stitch machine using a hot waxed thread is used for uniting the welt, upper, and insole. Welt-holding and cutting, also thread-holding and cutting devices, are on the machine. The wax and parts of the machine as required are heated by steam or electricity. (Fig. 58.) This machine is very rapid in action, making at least 600 stitches per minute, and it requires only ·43 h.p.

We do not intend to describe every minor operation but will confine our remarks to processes where important principles are involved. After the welt has been sewn in, it is necessary to remove the surplus material from the seam to make it as shallow as possible. For this purpose an inseam-trimming machine is used, a rotary

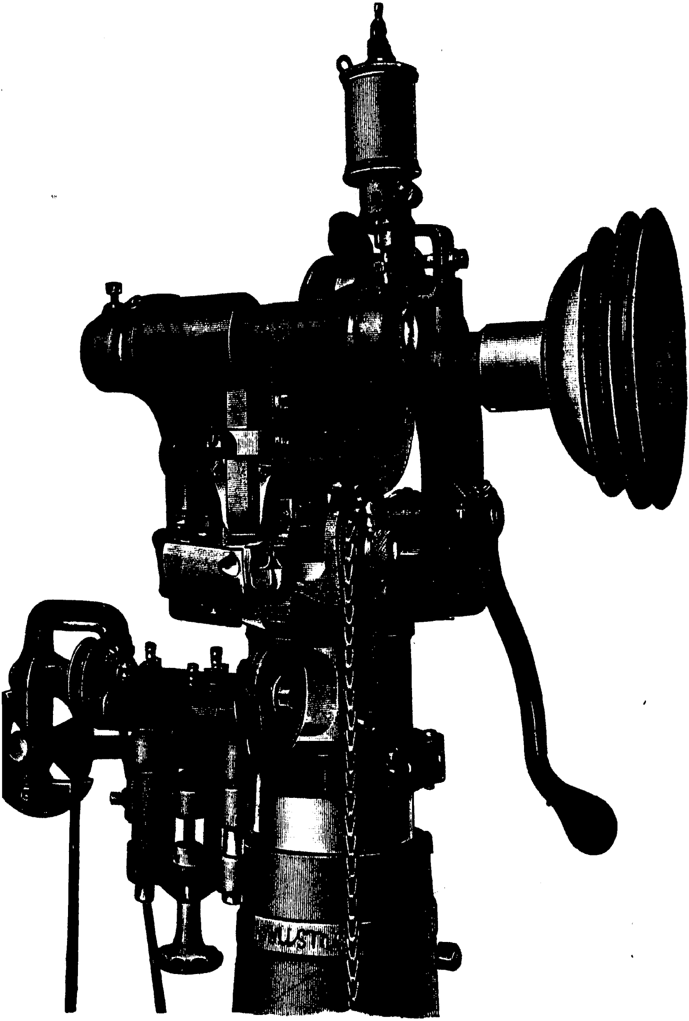


FIG. 59

INSEAM-TRIMMING MACHINE

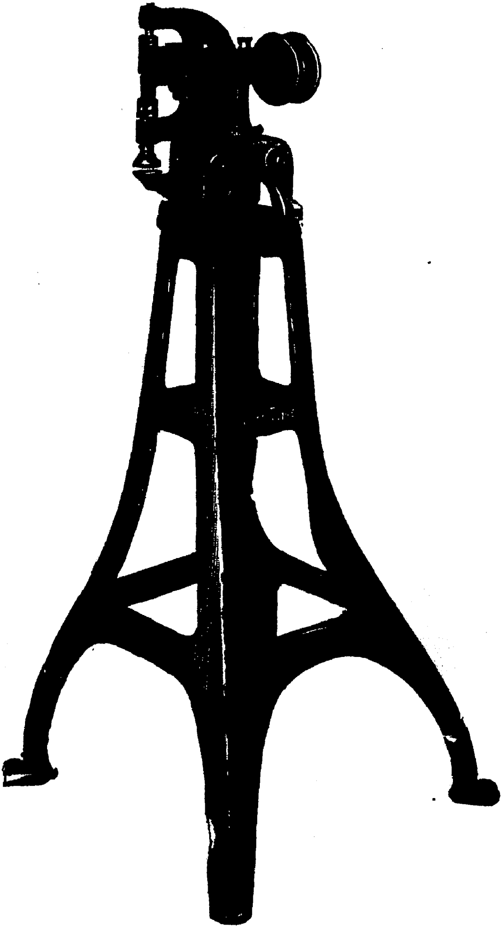


Fig. 60

WELT-BEATING MACHINE

knife doing the necessary work. (Fig. 59.) During the welt-sewing process there is a tendency for the welt to curl. As it is essential for this to be perfectly horizontal, a welt-beating machine is used to bring the welt to a horizontal position. (Fig. 60.) After bottom-filling and insertion of the shank, it is necessary to fix the sole previous to stitching. The soles, which are not cut to the exact shape, are coated on the flesh side with rubber cement and are temporarily fixed by means of a sole-laying machine. This is a power-driven twin machine, operated by a single treadle. The pressure is applied through a long spiral spring which, in conjunction with shaped rubber pads and compensation mechanism, ensures an even pressure being maintained on all shapes of lasts. (Fig. 61.) It is now necessary to shape the sole to conform to the shape of the last. A channel is also required near the edge of the sole for stitching purposes. Both of these operations are done by a combined rounding and channelling machine.

This machine is one of the most useful in the series. It rapidly and accurately rounds and channels the sole in one operation and is adjustable to suit any width of welt. Not only is the sole rounded according to the feather of the last, but the channel follows exactly the same outline. (Fig. 62.) The lip of the channel is now opened and turned back in preparation for sole stitching.

The sole is attached to the welt by means of a lock-stitch machine. Rapid strides have been made in the production of such machines. The latest type used for this purpose (Fig. 63) produces a tight and uniform stitch. The top thread may be either waxed or gummed. Unlike most stitching machines, the head mechanism is enclosed in cast-iron covers which exclude dust and retain heat, and less thread is used than in the older types. The heel seat of the sole may then be fixed with

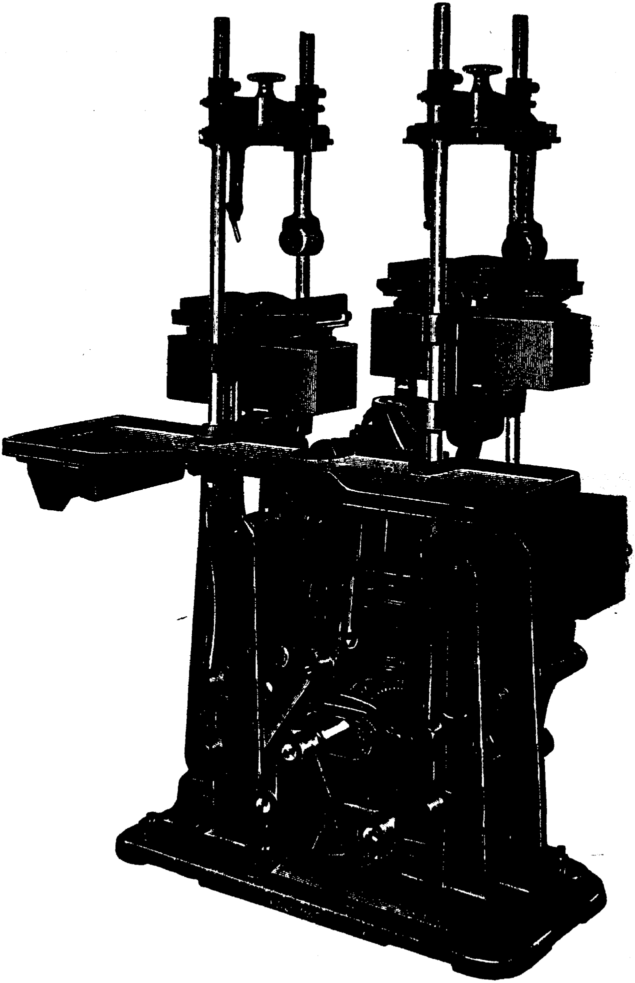


Fig. 61

SOLE-LAYING MACHINE

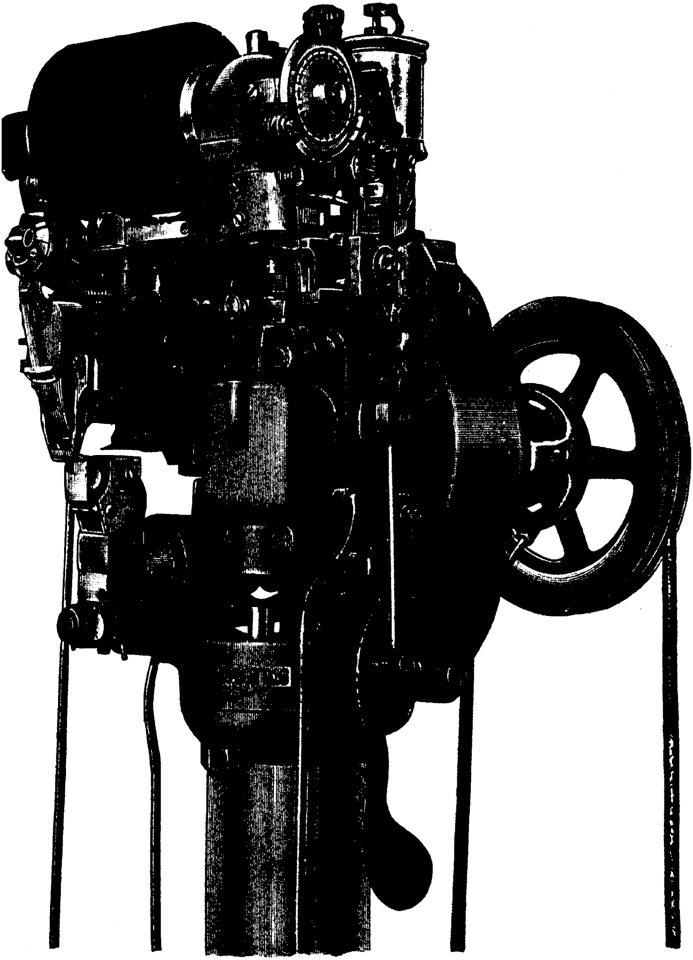


FIG. 62

ROUGH ROUNDING MACHINE

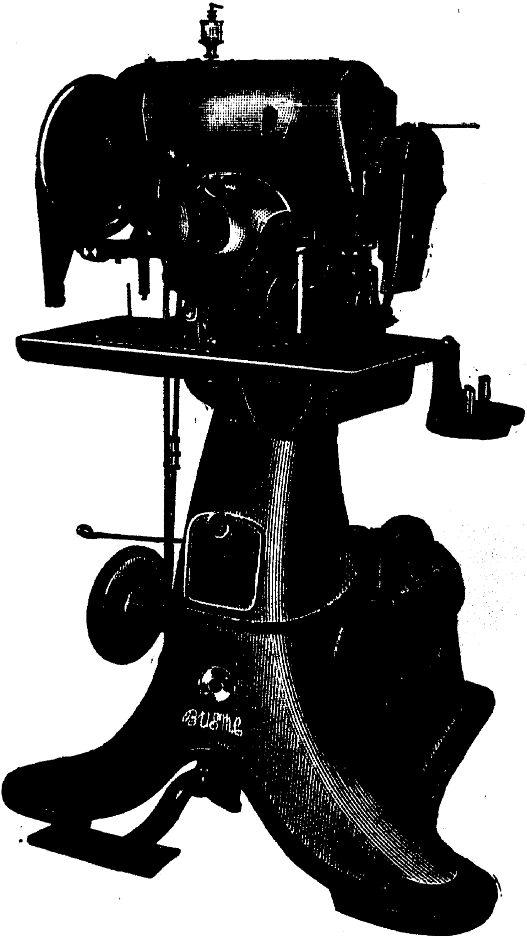


FIG. 63

SOLE-STITCHING MACHINE

screws, wood pegs, or fibre pegs. A machine for inserting the fibre peg has recently been placed upon the market.

After closing the channel, bottom-levelling is the next operation. For several reasons it is not advisable to apply too much pressure to the bottoms of welted work, neither should the pressure be direct. A machine with variable pressure is to be preferred, and in this instance one that will adapt itself to the various styles of bottoms. As welted work is levelled on the last, this is essential. The automatic sole-levelling machine (Fig. 64) answers this purpose. The angle of the rolls is adjustable to the position of the joint line, and adjustments may be made to suit each size, shape, and style of bottom. The pressure applied by the rolls is also easily adjusted to suit varying conditions.

Another flexible attachment is made by adopting the "Littleway" process. The uppers are lasted on a machine with staples instead of tacks. The staples, which are made from a very fine and soft wire, do not penetrate right through the insole; hence the face of the insole is left perfectly smooth. In attaching the sole, a lock-stitch sewing machine is used, making 750 stitches per minute. As the tension on the seam is so well regulated, the stitches on the insole are pulled well in, leaving a smooth and level inside. The process represents one of the most modern methods of direct attachment.

Blake-sewn work may be made almost as flexible as welted goods, especially when a single sole is used and there is no necessity to use a heavy insole. The nature of the seam made readily admits of light leather being utilized for this purpose. A sole attached on this principle would be considered as a direct attachment, a single vertical sewing-seam being used. As a channel is cut in the sole to cover the loop, a good substance is advisable. On heavier classes of work a half-middle is

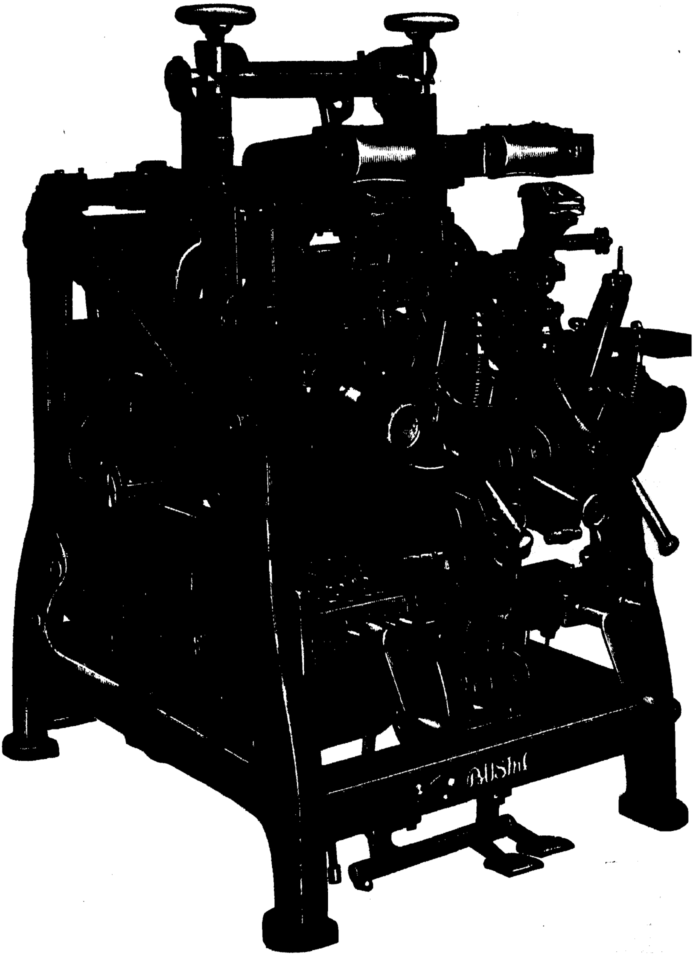


FIG. 64

AUTOMATIC SOLE-LEVELLING MACHINE

used in addition to the sole, which adds increased substance to the forepart.

Another method of attachment is produced by sewing and stitching. First a middle sole, which may be either half or through-middle, is sewn on to the bottom with the Blake-sewer, and the sole is afterwards stitched on to the middle. Where a half-middle is used, attachment must be completed by sewing the sole in the waist. This is an indirect attachment, a combination of two vertical seams being used.

The screwed and stitched method gives another type of attachment, and is similar to the one used chiefly for making the ordinary British Army boot. A good, solid, through middle is used, and is screwed by machine on to the insole. Leather required for parts that have to be screwed must be of good quality, firm and stout in substance, otherwise the screws would pull through. Where increased substance is required in the forepart, a half-middle is also included and is attached at the same time.

Riveted goods still constitute a feature of the productions in some factories, the rivet being used where it is desirable not to attach the bottoms with thread. As with every other operation, machinery is utilized for feeding and driving the rivets, and it is possible to put a large quantity of work through in a day. A properly made riveted boot is not as rigid as it would appear to be, as the leather required for the bottoms need not be heavy.

Insoles should be of good substance, with a firm grain, and the soles should also be firm on the grain side.

Very heavy classes of boots often have the bottoms attached by the screws alone. This of necessity makes a very rigid bottom, seeing that all the bottom stock must be thick and solid. One feature of screwed work is the smoothness of the insole, and another, the solidity of the fastening. The screwing machine cuts the screws off flush with the surface of the leather, and although soles are sometimes channelled for such work, the better plan is to have the screws aloft, thereby avoiding any weakening of the sole.

Although it would be difficult to find a more solid and satisfactory attachment for heavy work, it does not follow that the method of screwing is suitable under all conditions. Boots intended for a very wet climate, or to be worn under wet conditions, would be better pegged. Wood is used for this purpose, the pegs being cut from a ribbon of wood, driven through the leather, and cut off level on both sides by the machine.

Machine-pegged boots are liable to spring in the waist, rivets or a few screws being used as a preventive. In this case, the awl used to perforate the leather previous to driving the peg must be slightly larger, especially as very solid leather is required. The dampness of the bottom, however, soon causes the wood to swell, and it is this characteristic that makes pegged boots so suitable for wet conditions.

Much more could be written relative to attachment; a great amount of information may, however, be obtained from a description of the following processes.

Temporary Attachment for "Through Seams." With ordinary through-seamed goods a temporary attachment of the bottom is necessary previous to the permanent fixing of the bottom. Cement and tacks in various forms are used for this purpose. Light, single sole, Blake-sewn work would first have the sole temporarily attached by means of rubber cement. The sole-laying machine as used for welted work is used for this purpose. In the lower grades of work, and where a middle sole is used, the attachment may be made by means of tacks driven into the base of the sole channel. Sewn and stitched work must have the middle-sole attached separately from the sole; whether it be a half or through middle, a similar method would be adopted. When tacked, the sewing would be done with the "Blake" machine. Sole-laying is then a fairly easy matter.

Machines used for the purpose of tacking are similar in principle, although producing a different type of tack. The " Staple Tacker " is one of the most satisfactory machines for this purpose, and should be used in preference to other types, especially for light and medium work. This machine cuts, points, and forms its own staple from a single coil of wire, afterwards driving it into the leather.

The " Wire Grip Tacker " is another type of machine used for the same purpose. It cuts, points, and drives its own tack from a coil of thin, fluted wire. Having no head, the tack is very liable to find the point of least resistance during wear, which happens to be the sole of the foot. The wire is not sufficiently strong or suitable for tacking heavy bottoms.

For heavy work, a " Taper Nail-Tacking Machine " is most often used. The particular form of nail cut from a strip of steel is tapered or wedge-shape, and forms a very secure and strong fastening as a temporary attachment.

Boots that are to be riveted, screwed, or pegged would have the whole bottom attached by the staple or taper machines.

Sewing. Assuming that the soles or bottoms are fixed, the actual order of succeeding processes will depend upon the method of attachment used. Whatever method is adopted, the boots would ultimately arrive at the levelling machine. Machine-sewn work would have the soles sewn on by the " Blake " machine, which makes a chain-stitch with a single thread, the loop or chain being deposited at the bottom of the channel; from three to six stitches to the inch are used, according to the class of work. This type of machine was the first invented for sole-sewing; until recent years very little alteration has been made in the form of it. From 300 to 400 stitches per minute is its average capacity. Wax is generally used for lubricating the thread. The wax-pot in the latest machines is situated below the horn through which the thread passes. We have consistently recommended gum solution for this machine. Where this is used, results are quite satisfactory, and more so, seeing that lasts and linings cannot become marred with wax, which is always difficult to remove.

The latest form, the "Improved Blake Sewer," made by the British United Shoe Machinery Company, Ltd., is a great advance upon the old type. Unlike its predecessor, the needle always stops on the outside of the work; two speeds, giving up to 750 stitches per minute, can be used without stopping the machine, a very great consideration. On the old type, any increase or decrease of speed would have an effect upon the tension and appearance of the stitch. With the improved type, both speeds may be used on one boot with equal results.

Most of the difficulty found in operating is due to the improper condition of bottom stock. Under normal conditions, the hook or needle, as it is termed, perforates the leather with a hole much larger than the thread used. This is necessary in all types of sewing machines, but if the leather is dry and hard, a much larger hook is required in relation to the substance of the thread. With leather in proper condition, an 8's hook is used with an 8-cord thread, a 6's hook with 6-cord thread, and so on.

When a half-middle has been sewn on, the sole is stitched to the middle in the forepart only, and the waist is completed by sewing with the " Blake " machine. If through-middles are used, stitching would be carried down to the heel position, or, in some cases, stitched along the outside and down to the inside joint, the inside waist being completed by sewing.

Stitching. Machines used for stitching are similar in principle to those used for welted work. A curved awl is used for piercing the leather, followed by a curved needle with a barb near the end for picking up the thread. A lock-stitch is formed by the interlocking of the spool and shuttle threads, making a solid and flat seam. With the material in good condition, most operators use the same size in awls and needles, according to the substance of the thread. Compared with sewing, a stouter thread may be used for stitching, and the needle need not be so large.

Through-seamed boots must have the lasts withdrawn before going to the attaching machine; where the constituent parts of the bottom are fixed together previously, the last would be slipped as soon as tacking is completed, but on work having middles, lasts must be slipped before being sewn or otherwise fixed. In this case it often happens that the sole is attached without again inserting the last, which is a great mistake, as the goods are improved by remaining on the lasts as long as possible, and since a last is essential if good stitching is desired, the extra labour entailed by removing and returning the lasts should not be considered.

Where there is no intention of the work being re-lasted, the seat may be tacked round when the sole is fixed; otherwise it is an advantage to rivet or screw the seat, especially for medium or heavy goods.

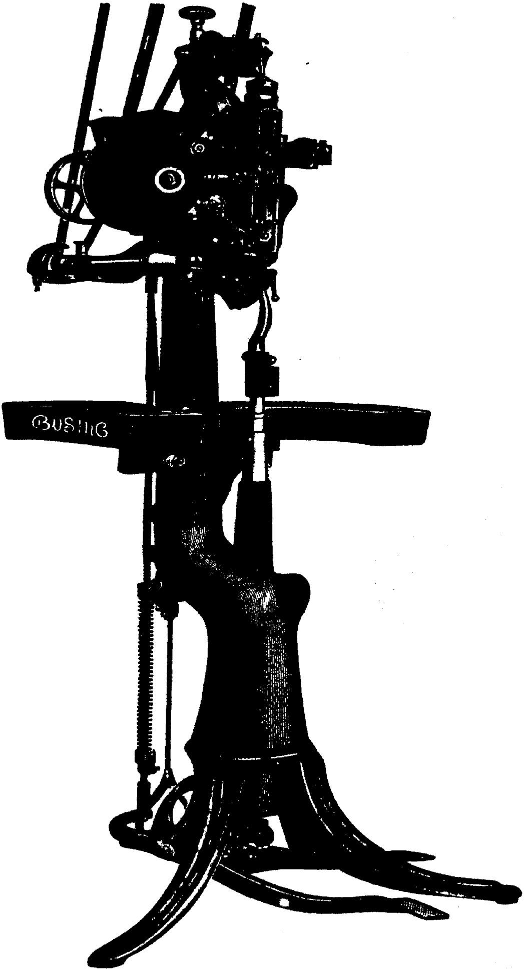


Fig. 65

LOOSE NAILING MACHINE

Heavy boots often have the through-middle sole riveted on when the sole is to be stitched. Other kinds of work have the whole bottom riveted through to the insole. The machine used for this purpose is known as a Loose Nailing Machine. It may be used for riveting the bottoms of shoes off the last, also for nailing heel seats and low heels either on or off the last. The machine is provided either with a single hopper (for holding the rivets) and raceway, or with a double hopper and double raceway, which accommodates two lengths of rivets, either of which is used as required, the change from one to the other being made instantaneously. The spacing is effected by an awl, which pierces the leather for the reception of each rivet, the distance between the rivets being regulated as required. As the machine is often used for nailing heel seats, when required, a heel seat rounding attachment is added to the machine for trimming the edge of the heel seat to the shape of the last. Thus the two operations, nailing and rounding, may be done simultaneously. (Fig. 65.)

For screwed work, the machine used for inserting the screw is known as the "Rapid" Standard Screw Machine. This automatically inserts, cuts off, and spaces the screws from a coil of brass or iron screwed wire, the length of the screws ranging from ¼ in. to ⅞ in. in the regular machines, and 1¼ in. in special machines. The screw wire is placed on a spindle in the head of the machine, which revolves at a rapid rate and screws the wires into the sole at 300 per minute. The machine automatically measures and cuts off the screws to a correct length to suit the varying thickness of material, leaving the inner and outer surfaces perfectly smooth. The same machine may also be used for securing the heel seats of outsoles to insoles and low heels to outsoles. (Fig. 66.)

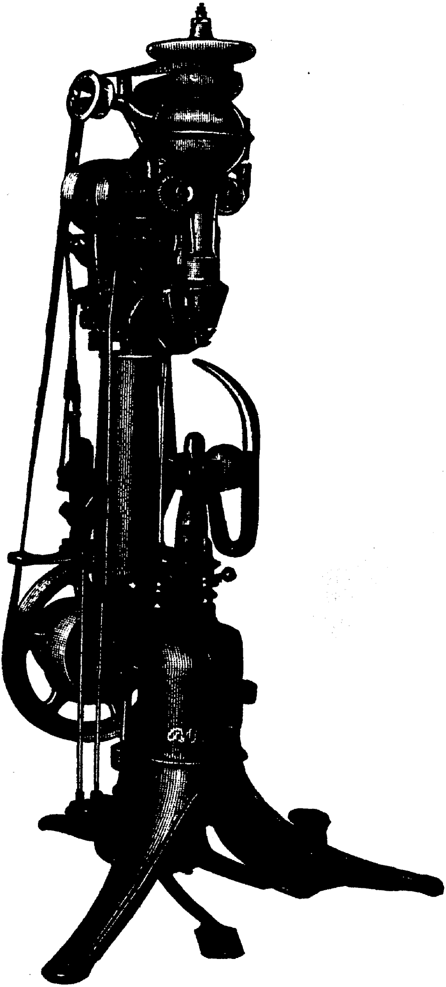


FIG. 66

"RAPID" STANDARD SCREW MACHINE

Where channels are used, they would now be closed as explained for welted work, and the next process is bottom-levelling. We have already described one kind of machine used for this purpose, and although it is possible to level any class of work fairly satisfactorily with the " Auto " machine, other types are preferred, because the necessity of re-lasting is again obviated.

Levelling. The " Hercules Levelling Machine " is one very largely used for men's medium and heavy work. Direct pressure is exerted, but it is applied with a walking motion; moulds similar in shape to the bottom of the last are fixed to a crank action above the machine. When in motion, the heel portion of the mould descends upon the heel part of the boot, pressure being gradually applied to the whole bottom. Each part of the machine moves alternately, and as one boot is under pressure, one is being removed and replaced by another.

For medium or light work another type of machine is preferred. A machine suitable for the purpose and at the same time adaptable for welted work is recommended. (Fig. 67.) On this machine, through-seamed work is levelled by means of iron feet and forms, made to coincide with the shape of bottom required, while for welted work, the last, as previously stated, is not removed, but by a slight adjustment may be used on the same machine. In factories where both through-seamed and welted goods are made, this is a great advantage.

Heeling. Heel-attaching is the next operation, although in some factories, especially where men's work is made, the edges of the sole are first trimmed. One of the advantages claimed for this is that it assists the heeler to get the heels on more satisfactorily, and, since we go to the trouble of rounding seats, it would appear as if trimming should follow, even though the operation is one connected with the next department; but whether trimmed or not, the work would next pass into the heeling department.

The heels already made are assembled in bins, with or without the top piece attached, according to the method of heeling adopted in a particular factory.

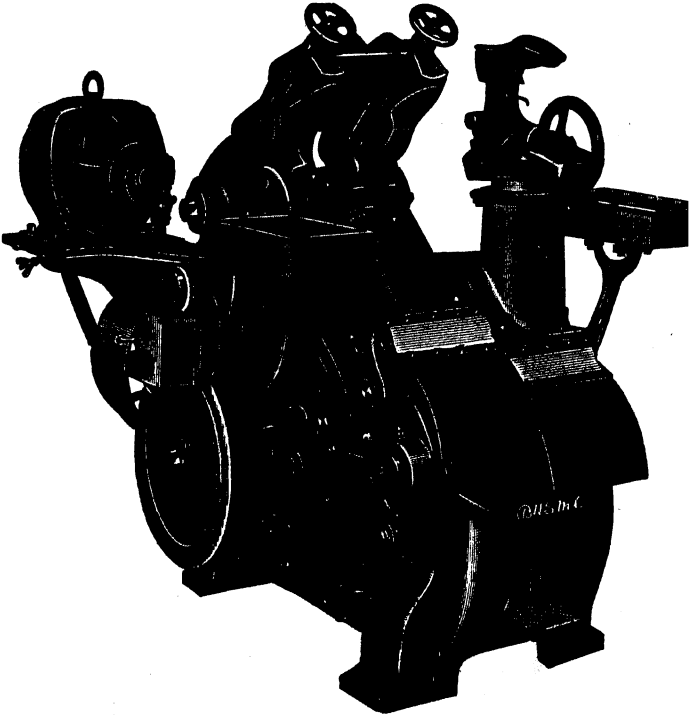


FIG. 67

BOTTOM-LEVELLING MACHINE

With the use of modern machinery, two distinct methods of attaching are adopted, inside and outside. Sometimes a combination of the two is used. By the outside attachment there is no necessity to remove the last, but for inside attaching, the last must first be slipped. There is considerable difference of opinion concerning the two methods, although both will secure the heel satisfactorily, if proper nails are used. In the case of welted work, where the lasts are not removed, outside attaching must be adopted, and for this purpose rectangular nails without heads are used; they vary in length according to the height of the heel.

One kind of machine used for this purpose is known as the "Lightning Heel Attacher," which drives the nails by a plunger action, leaving them standing about ⅛ in. on the outside, in order that the top piece may be fixed. The nails are fed through a template by a boy or girl. The boot is placed on a stand with the heel in position, when the plunger descends and drives the nails into the insole. The top piece is then placed in position and attached by a repetition of movement.

Another type of machine, more automatic in action, attaches the heel by means of cut nails, which are fed down a tack race. If a tack gets into the race, point upwards, a special device turns it into the correct position. (Fig. 68.)

When heels are attached in this manner, the next operation would be nailing round the top piece, which is termed "slugging." Slugging machines drive a shaped metal wire into the solid leather, usually cutting off the length required from a coil of wire of various shapes, and afterwards driving it into the leather. Most of the machines of this type have an awl, which first punctures the surface. A driver then descends and fixes the cut-off. The length of the piece cut can be regulated, and in any case should go well through the top piece. If attached by the inside method, the top piece is often fixed and slugged previous to attaching.

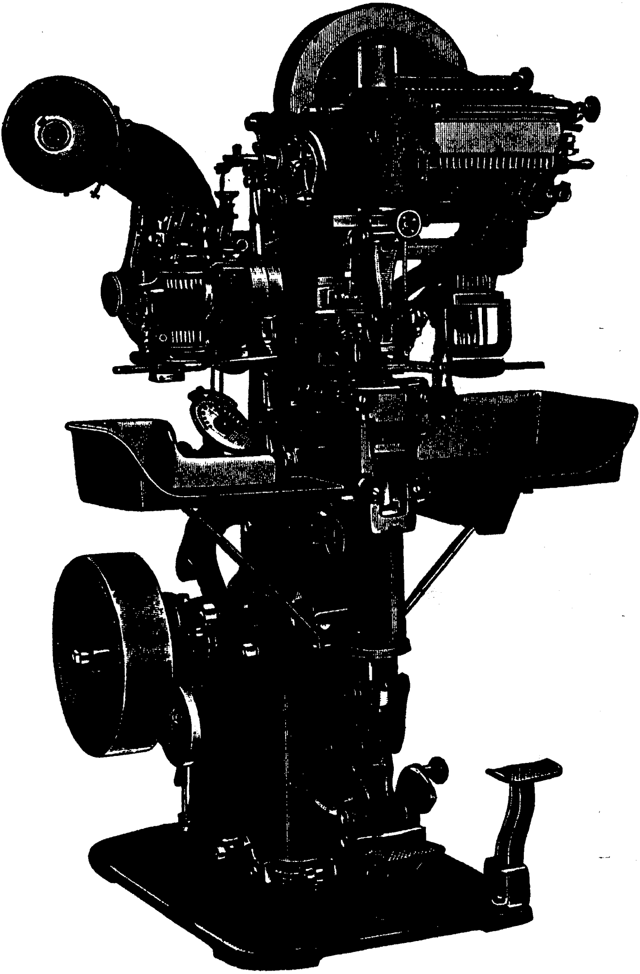


FIG. 68

AUTOMATIC HEEL-ATTACHING MACHINE

A machine like the one first described would be used, the boots being placed on a stand into the top of which nails have been fed head downwards. When the heel is in position, it is fixed by means of a plunger working under the stand, driving the nails upwards into the heel and leaving the heads showing on the surface of the insole.

Heels. There are many different forms of heels. Those used for ladies' work are commonly known by the names of "Louis," "Cuban," "Spanish," "Military," etc. The chief distinction between the various types is determined by the shape of the back or front in relation to the top piece. To a certain extent, the height of the heel is also determined by its form or type. We should, perhaps, be treading on dangerous ground if we were to suggest that no heel should exceed a certain height. It is not uncommon to see heels varying in height up to 6 in. This size is, of course, a freak, yet many of the average types are unnecessarily high. When made from solid leather, heels of extreme height would be too heavy for modern footwear. They are, therefore, often made of wood and other materials.

For a good "understanding" the solid military heel is most suitable. This type of heel usually has a single curve at the back, with a small top piece placed relatively forward, and the breast is often perpendicular. On account of its solidity this heel should not exceed 1¾ in. in height. The "Spanish" heel, often made of wood, resembles a stick with a back curve attached. The top piece is about the size of half-a-crown and its height may be almost anything within reason. This is a very popular type, even though it has probably caused more sprained ankles than any other heel used on ladies' footwear. The "Cuban" heel has a short broad top piece and the breast is not perpendicular. The back curve is symmetrical and in height it may vary between 1½ in. and 2½ in., according to the materials used in making. "Louis" heels are very extensively used and vary in height considerably. The wood shape is usually covered with leather to match the upper; the seat of the sole is split and the grain surface is brought up the breast of the heel. A special plant of very ingenious machinery is used for dealing with this type of heel. Heels intended for men's and boy's work are usually referred to as being "square." The breast may be hollowed out or cut straight according to the effect required, but in all cases it should be perpendicular to the ground when attached. On account of its solid nature this heel does not usually exceed 1⅛ in. in height.

With ordinary built heels, the cutting down of the front, an operation known as "breasting," is done before the heels are attached. In some old-fashioned factories this process is still done on the shoe. The great disadvantage of breasting when the heel is attached is the possibility of cutting the sole. We have seen all the labour entailed in making a shoe destroyed by this operation. Naturally, such accidents are due to the careless adjustment of the machine, and need not occur; but so long as we have the human element to contend with, there is always the possibility of such results.

CHAPTER XI

FINISHING

LIKE every branch of the trade, finishing has developed very rapidly of late years. In the past, solidity was the main point aimed at. To-day neatness and artistic merit are as important, and the finisher must be able to turn out work possessing these qualifications in the highest degree. The days have gone when to be a finisher involved a knowledge of every process, from paring to polishing off. To-day, finishing is so divided and subdivided that one operator does only one part of the whole process.

The responsibility for producing good results rests chiefly with the head of the department. He has to see that each of the many operations performed is as nearly perfect as possible. The work must be kept moving round the room, otherwise a block will occur which will upset the organization and decrease the output of the department.

Good finishing is dependent upon good machinery, and without these it is impossible to produce satisfactory work. The setting out of a finishing plant depends upon: (1) Shape of the room, (2) quality of finish required, (3) variety or type of work.

To enumerate or to give an ideal set out for every class of footwear in a volume of this character would be to attempt the impossible. We must, therefore, content ourselves with one or two general examples.

Set Out. The various processes in machine finishing may be divided into four sections, and it will be found that in most factories these take the following order :

(1) trimmers, (2) scourers, (3) setters, (4) burnishers. From this it naturally follows that the machines used for trimming operations must be placed in a position as near as possible to the entrance from the heeling-room. The machines contained in the remaining sections would then be spaced between these and the exit, in such a manner as to enable the work to be moved round the room in one direction. Very few factories are alike in the order, spacing, or arrangement of this department, although it will be found that the operations, as a general rule, follow in the order given, according to the type of work.

Order of Processes. (1) Lasting, (2) heel-trimming, (3) welt-ploughing, (4) edge-paring, (5) heel-scouring, (6) stitch-cleaning, (7) stitch-separating, (8) heel corner shaping, (9) bottom-scouring, (10) bottom-buffing, (11) inking, (12) fudging, (13) edge-setting, (14) heel-burnishing, (15) seat-wheeling, (16) bottom-burnishing, (17) painting or staining, (18) polishing, (19) bunking, (20) crowing, (21) beading, (22) polishing off.

Considerable variation in the order of some of the processes could be made if desired. For example, some prefer to scour the bottoms before attending to the stitches (if any); others burnish heels before setting the edge. But whatever method is adopted, convenience with regard to the succeeding operations must be considered.

Lasting. In this department, lasting consists of inserting a filler or last similar in shape and size to the original making last. If this is neglected, the constant handling will spoil the shape, and most of the labour of previous operations will be lost. Any shape of last will not do; the filler *must* be in conformity with the shape of last on which the boot or shoe was made. The goods should also be laced or fastened up, to prevent linings being soiled, and to assist the leg to retain a good appearance.

Heel-Paring. Machines used for this purpose give the correct shape to the heel by removing the superfluous leather round the edge. Several types of machines may be used, one of the best known being the "Ultima." Two cutters are fixed into the head of the machine, which turns at about 6,000 revolutions per minute. The cutters must be kept sharp and true to shape. This is worked in conjunction with a grinding machine, and owing to the construction of this particular kind of cutter, with average care in grinding, the shape will be retained until the cutters are worn out. What is known as a rand cutter is included on this type of parer, and this consists of an arrangement which takes the "bit" or rough edge out round the seat of the heel, thus making a true line with the sole. Covered heels used on many classes of ladies' footwear do not need paring ; they do, however, require special treatment, which necessitates the use of machinery of a different kind.

Welt-Ploughing. This operation is often termed "bitting," the object being to level the welt as a foundation for the next process. The angle at which the cut is taken is important, and will depend upon the width of welt ; generally from 10° to 15° from the feather edge is sufficient. In any case the bevel must not be great, otherwise edge substance will be reduced. The operation applies chiefly to machine-sewn work, or work of a similar nature, since when the welt is stitched it is not advisable or possible to take more out, excepting at the extreme edge of the welt. For medium and common class goods, machines are generally used for this purpose, but for higher grade work the operation is considered better done by hand.

The tool used, termed a welt plough, has a guard to prevent any damage to the upper. The machine method is similar, the cutting knife being protected by a guard upon the same lines as in the hand tool.

Edge-Trimming. The operation of edge-trimming gives the final shape to the sole, removes all roughness, and prepares it for compression and burnishing. For successful trimming, the edge must not be perfectly dry or harsh, but should be in a mellow state. The condition of the work all round the factory is very important, and it is now possible to use mulling cabinets or chambers in any department, either for supplying moisture, or for drying purposes. In the finishing department, in order to obtain the best results, some operations demand mellowness, others dryness; hence the use of cabinets is of great advantage.

As no other work is put into the edge before setting, it is very essential that the trimming should be well done, and often two trimmings are advisable. When the edges are trimmed with the heels attached, it is not possible for the operator to trim quite close to the heel. Until quite recently, the little unevenness near the heel had to be removed by hand; now, however, a suitable attachment is fixed on to the trimming machine, and this completes the operation. The machine illustrated (Fig. 69) has two cutting shafts and a shaft for driving the fan for dust extraction, all mounted in ball bearings. A power-driven grinder for sharpening the cutters is mounted on the machine stand.

Cutter. The circular cutting tool of the machine is made from a solid block of steel, and consists of sixteen distinct cutters or teeth, all having the same shape. The edge of the sole is held to the cutter and drawn towards the operator, while the cutter revolves. The movement begins on the right-hand side of the waist and finishes off on the opposite side, as near the corner

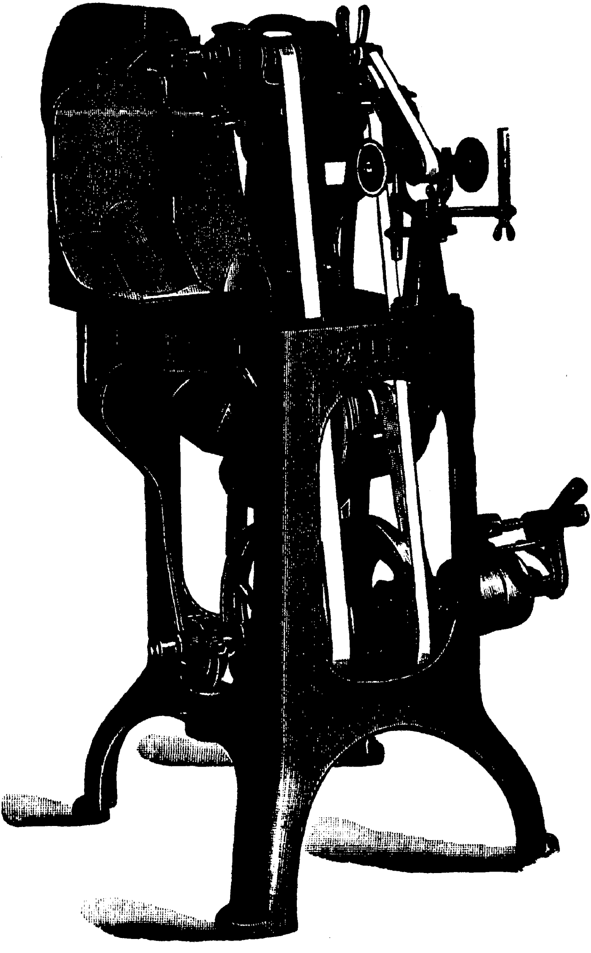


FIG. 69

EDGE-TRIMMING MACHINE

of the heel as possible. An even pressure must be applied, as any unsteadiness of the hand would produce an uneven edge.

Different classes of work require trimmers of various shapes and character. Heavy work is usually trimmed with a square edge, and lighter work with a hollow edge. The effect required is obtained by making a variation in the shape of the bed of the cutter.

Grinding Cutters. If good results are to be obtained from the machine, special attention must be given to the cutters. They must be kept sharp and properly ground, a detail often overlooked in the factory. The angle which is formed by the two surfaces of the cutting teeth is the perfect one, and this angle should be preserved when grinding. An appliance for grinding is fixed to the machine, and consists of an emery wheel and a movable post for resting the cutter on. The position of the post in relation to the emery wheel is of the utmost importance. An examination of the cutter will show that the face that has to be ground forms a tangent with the core of the cutter. It follows, therefore, that the edge of the post and the emery wheel should be in a direct line, one with the other, and when this is the case the cutting angle is never destroyed.

Identity of Cutter. Most cutters have certain letters and figures upon them that have a direct bearing upon their shape and size. Excluding those for special shapes, there are practically three types: (1) no lip, (2) one lip, (3) two lip cutters.

The bed or width of a forepart cutter is measured from side to side. Assuming a mark of 14.B.0000, this would indicate size $14 = \frac{14}{48}$ in. B relates to degree of curvature or otherwise in the bed of the cutter; 0000 signifies no lip.

We will take another example, as **36.F.000.2.26°.**

The first figures again give the size in forty-eighths of an inch; the letter F relates to the shape of the bed, 000, one lip; the figure 2 applied to the lip shows it to be $\frac{2}{32}$ in. deep, and the 26° means that the lip is pitched at an angle of 26 degrees.

A two-lip cutter may be marked as follows: 12F.394. 1½R.45°. This is more complicated, but as in the previous examples, 12 denotes the size, which equals $\frac{12}{48}$ in., F the shape of bed; 394.1½R. signifies a double lip cutter; the first three figures relate to the sole lip, the 1½ to the welt or guard side, and the letter R means the welt crease is raised. An examination of the lip on the sole side will show it to be divided into two portions. The figures 394 indicate that the first portion near the bed will be $\frac{3}{64}$ in. deep, and the second portion $\frac{9}{64}$ in., the 3 and 9 giving these measurements respectively, and the 4 implying sixty-fourths. The 1½ gives the depth of welt lip in thirty-seconds of an inch, and 45° its pitch.

Heel-Scouring. The object of heel-scouring is to smooth and polish the heel previous to burnishing. The result is obtained by the use of abrasives fixed to and round broad faced wheels. Heel scourers should not be expected to shape the heels; that is already done, but very often too much is left for the scourers, with the result that the abrasive is worn more rapidly.

The sectional shape of the disc or wheel should be the same as the pared heel if flat or square; for hollow-shaped heels the section would be more convex. As a rule, the machine is fitted with two wheels and a brush for removing dust. One wheel would be covered with sand-paper, the other with fine emery-cloth.

Rough scouring is done first, and care must be taken not to destroy the shape of the seat or top piece. Too much pressure must not be applied, otherwise the leather will be burnt by excessive friction; it will then be almost impossible to obtain a satisfactory finish. As one object of rough scouring is to remove all inequalities left over by the parer, so the object of smooth scouring is to remove all trace of rough scouring, and at the same time make the heel smooth and hard on the surface.

The movement of the boot in scouring should be from one corner of the heel to the other. To break off and start again tends to make badly shaped heels, and certainly increases the amount of labour required.

Stitch Cleaning. When boots are welted or have stitched foreparts, etc., it is necessary to make the welt level and remove surplus wax from the stitches. If a natural coloured welt is desired, a solution of gum arabic and oxalic acid is often used for cleaning purposes. Where welts have to be black, oxalic must not be used, seeing that the acid would turn the ink brown.

The tool used for cleaning is usually a bone, wedge-shaped at the end, with a number of corrugations on the face, which comes into contact with the welt. The application of the gum, and the pressure applied, also improve the welt. After cleaning, the welt may be polished by hand or on a power brush. Seeing that this operation is often done before scouring is completed, the gum, which also has a hardening effect on the stitches and welt, helps to prevent any dust discolouring the polished part during after processes.

Stitch-Separating. Where work is made by the welted method and in other classes of stitched soles, it is often necessary to make an indentation between the stitches. This answers two purposes: the primary object is to tighten the stitches, and the process also adds to the appearance of the welt. The machine used for this purpose is a fellow one to the "Rapid Stitcher" (Fig. 70). At each stroke of the machine the indentor, as it comes

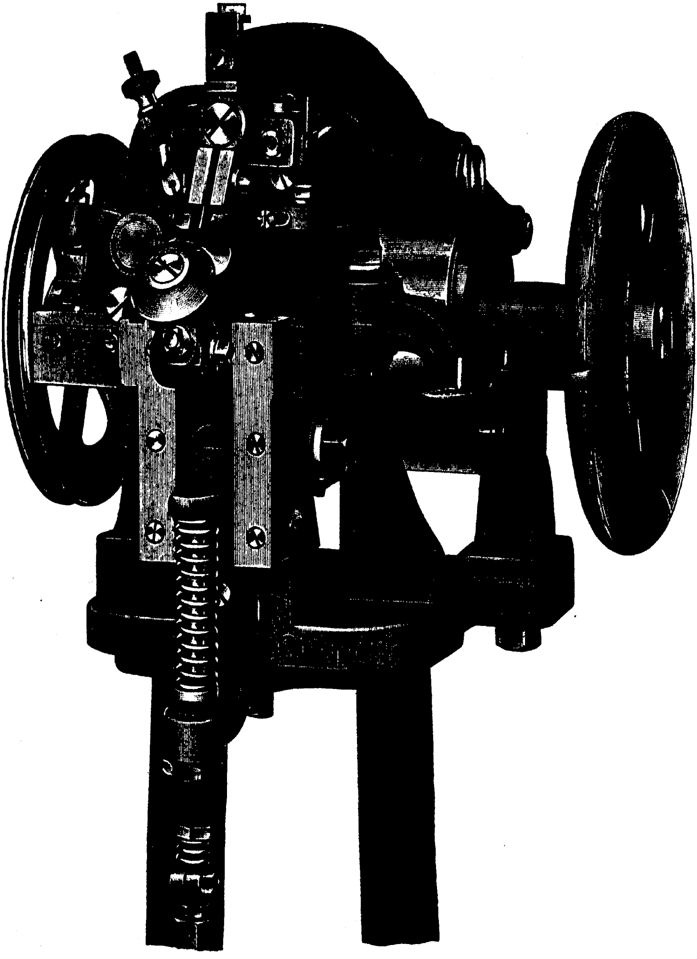


FIG. 70

STITCH-SEPARATING MACHINE

into contact with the welt, slides across it, the indentation being made the full width of the welt. The machine is adjustable for various lengths of stitches and may be relied upon for accurately making the indentations between them. The speed of the machine is controlled by a treadle, operating a variable speed transmitter, so that the machine may be run at its greatest speed while indenting the sides of a shoe, and slowed down, if necessary, when working round the toe.

Heel Corner Shaping. During the processes of heel paring and scouring there is a tendency to destroy the well-defined outline of the heel, chiefly at the corners. This portion must now be squared up and the seat should also be put right, if the effect of scouring has destroyed the true outline.

Bottom-Scouring. The preparation of the surface of the sole for whatever finish is to be applied is of the greatest importance if good results are to be obtained. For good scouring, it is necessary to remove the grain from the surface and leave it as smooth as possible. The portion of the surface termed "grain" is, in this instance, a thin artificial layer just over the true grain. If too much is scoured off, the surface will show up rough and prevent a satisfactory finish, and if too little is taken off, or if it is not scoured evenly, the finish applied will not strike in the same all over. The finished bottom will then have a patchy appearance.

The abrasives are fixed in various ways, generally on cylinders covered with felt or leather. Sand-paper is used first, for rough scouring, and emery for finer scouring. In machines of the "Master" type, the cylinders not only revolve but reciprocate at the same time. This is a great advantage over older types of scouring machines as it prevents scratches showing on the bottom.

Bottom-Buffing. The machine used for this purpose works by means of a small circular cap, fitted on to the end of a vertical spindle having a rotary motion. Very often this attachment is included on the bottom-scouring machine. The object of buffing is to give an extra smooth scouring to the bottom. The construction of the machine enables the operator to scour close up to the heel and in the waist, where it is not always possible to use the ordinary scourer. If the forepart is scoured properly in the first place, there should be no need to use the buffer, except for uneven soles and in the waist or on the top piece.

" Keep moving " is an excellent motto for the scourer and buffer. A slow action, or a short stop on any part of the bottom, will militate against a level surface being produced.

Inking. Although apparently simple, inking requires a certain amount of skill, and many factories realize this. The ink must be put on evenly and without bubbles; the brush should be moved in one direction, and should also be of the best quality. The introduction of waxed inks has made the application more important. In inking edges there is no necessity to paint the upper at the same time. Not only is the practice a waste of good ink—it involves labour to remove it.

The character and quality of the inks used are of great importance, and the selection will depend upon the nature of the parts to be inked. The primary purpose of the ink is to stain, but under modern conditions of machine finishing some filling properties are required, and when friction methods of burnishing are employed, a certain proportion of wax must be present in the ink in order to give a satisfactory polish; on the other hand, where a wax finish is desired, an ink having good staining properties is desirable.

Fudging. This is often referred to as " welt wheeling," and consists of marking or printing the welt, when this is not stitched. The underlying principle of the operation is to make the welt solid, and where middle-soles are used it also helps to bind the middle-sole to the sole. It is as important for the welt to be well set as for the edge, and similar reasons apply. The method of fudging depends upon the quality of finish required. One machine method will fudge the welt at the same time as the edge is set, or the process may be done separately by machine. For good class work it is better done by hand. The operator in this case has more control over the wheel, and, consequently, better results are obtained. Also it is possible by this means to keep the wheel well up to the upper. In some factories, fudging is done after setting. This is a bad practice, as there is a danger of damaging the edge. When fudged before setting, damage is avoided, even though a light application of the wheel may be necessary afterwards.

Edge-Setting. The object of setting is to compress and burnish the edge of the sole. At the same time, it binds the sole and middle or welt together and gives a well-defined shape to the bottom. Not only is the appearance affected, but the wearing qualities are improved, seeing that the compression solidifies the fibres and prevents the easy absorption of water. The ideal edge should be an intense black (if black is required); it must have a smooth and brilliant polish, and the crease marks should be well defined.

Machines used are of two types: rotary and vibratory. Rotary setters are not very satisfactory, and are used only for cheap and light work. The most satisfactory results are obtained by the use of machines having vibrating setters. Too much vibration is detrimental, as the greatest power is in the centre of the stroke.

Recently automatic setters have been placed upon the

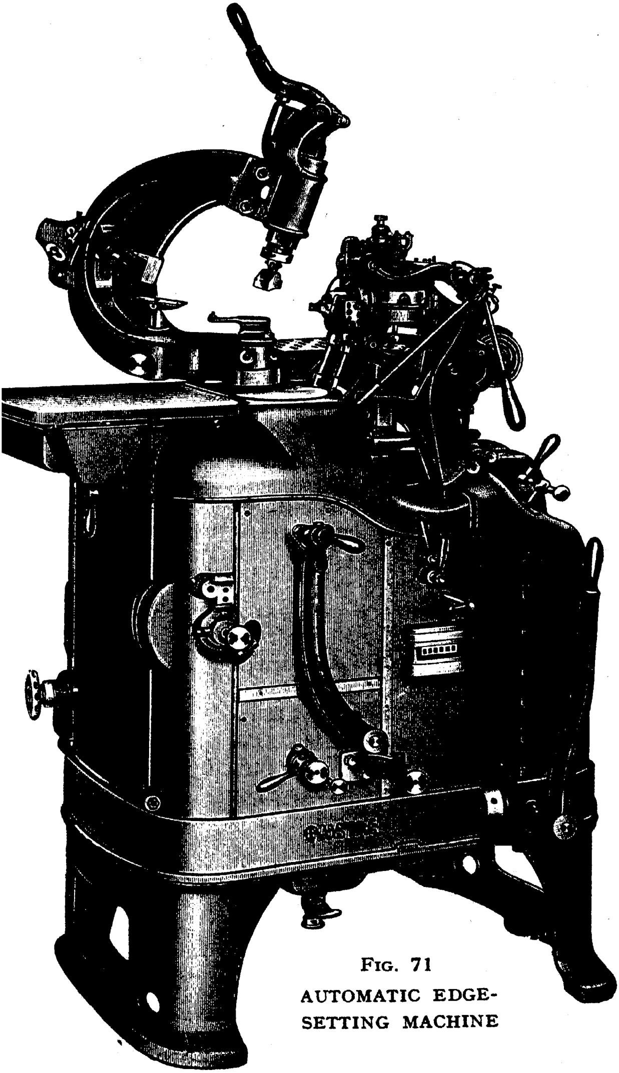


FIG. 71

AUTOMATIC EDGE-SETTING MACHINE

market by the British United Shoe Machinery Co., Ltd., and have proved very successful. A shoe is placed in the jack and the setting iron is put in contact with the edge of the forepart at the joint on one side of the shoe, and the setting operation proceeds automatically around the forepart to the joint on the other side of the shoe. As this type of machine only sets the edge of the forepart, the waist portion must be completed on the ordinary "Regal" machine. (Fig. 71.)

Heel-Burnishing. Various types of machines are used for burnishing the heel. Some use heated rolls; others depend upon friction. The former is often termed the "hot kit process," the latter the "cold kit process." A machine like the "Universal Heel-Finishing Machine" is of the former type. Included in the machine are an electrically-heated waxing roll for spreading the wax, a polishing roll, and a brush and seat wheel. If preferred, the waxing roll may be made to be heated by hot oil circulation, heated by gas.

The cold process depends upon a waxed ink. The ink is painted on to the heel, and, when dry, is burnished by friction, first on a pad, then by means of a brush. It is important to use a good quality ink for this process. Many of the low grade inks contain a large proportion of paraffin wax, which has a low melting point; consequently, a small amount of friction will melt the wax and wipe it off the heel instead of burnishing it.

There is not much doubt about the merits of each process. The hot process will enable the leather to absorb a certain amount of wax; hence the heel will have a more permanent finish. (Fig. 72.)

Seat-Wheeling. The imprint of a series of fine marks placed round the seat of the heel is known as seat-wheeling. The object is not merely ornamental, but designed to set up the seat close to the upper and

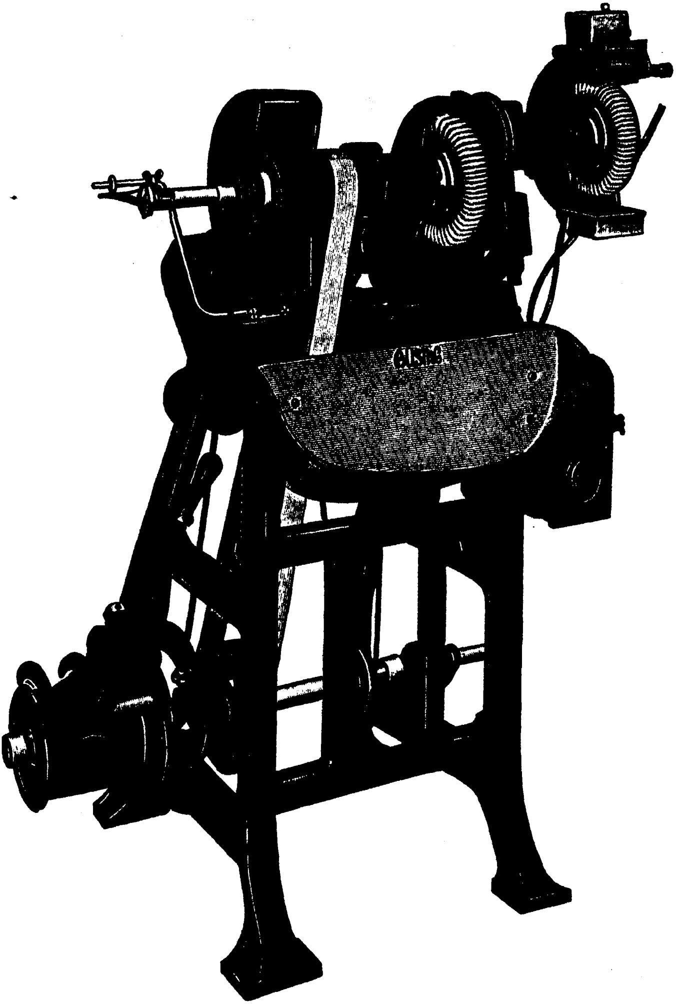


FIG. 72

UNIVERSAL HEEL-FINISHING MACHINE

protect against water and wear. This also may be done by machine, although on good work it is often done by hand. The seat-wheel iron is made on the same principle as the setting iron, but has only one lip, and the wheel which makes the mark is inserted close to the lip. Machine seat-wheels are circular in shape and rotary in action. The print should terminate exactly at the end of the heel on each side; it is on account of the liability of running over that the hand tool is used on better class goods.

Bottom-Burnishing. Either the hot roll or the friction method may be used for the purpose of burnishing bottoms. Probably the brush and pad is most often used for the average class of work. This machine is a very simple arrangement, consisting of a shaft having pads of different shapes, and both hard and soft brushes. The different shaped pads are required for the variations in the shape of the bottom. A flat, broad-faced one is used for the forepart and a narrow, slightly bevelled pad is used for the waist. Waxes and polishes are used in conjunction with them. To polish the bottom, the boot is held to the pad and drawn towards the operator, sufficient pressure being applied to remove all residue from the ink left on the surface of the bottom. The hard brush is then applied for smoothing, and the soft brush for polishing off.

A higher grade finish is produced on the bottoms and waists of shoes by using a wax finish. The "Bottom-Finishing Machine" is used for this purpose. The machine includes a waxing roll, bottom and waist polishing rolls, waist-finishing, Naumkeag, etc. The waxing roll is heated electrically and means are provided for evenly distributing the wax on the roll before it is transferred to the bottoms of the shoes. The waxing roll, polishing rolls, and Naumkeag are fabric-covered

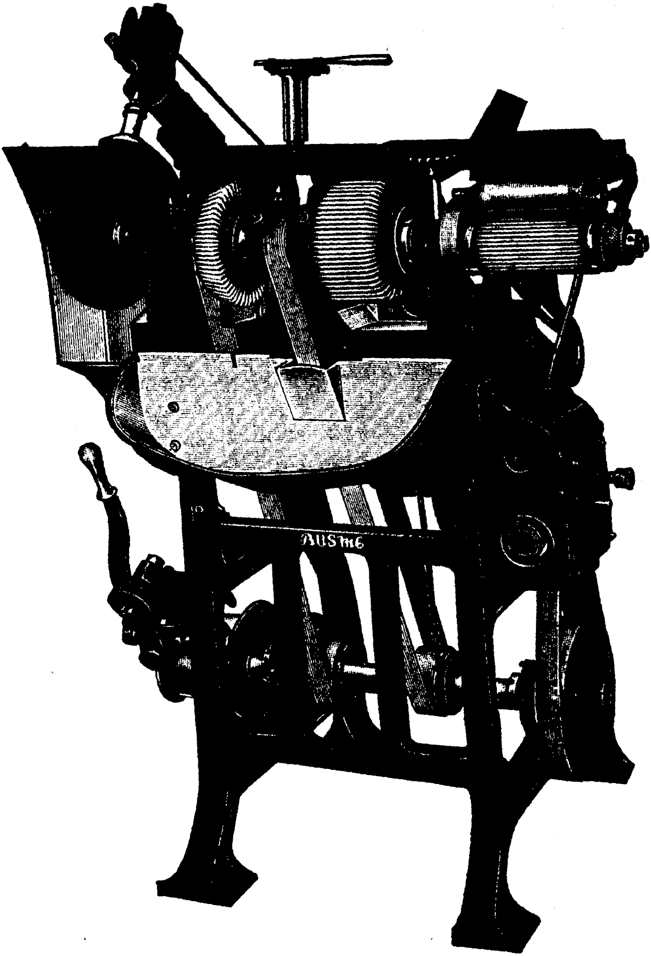


FIG. 73

BOTTOM-FINISHING MACHINE

and rapidly produce a highly finished surface on bottoms and waists, the process being completed by the brush. (Fig. 73.)

Painting and Staining. If badly done, painting or staining gives the boot a cheap appearance. The first essential to good work is cleanliness; all paint holders should be kept clean and free from grit, brushes should be of the best quality, and should never be allowed to stand in the holders. Paints should be thoroughly mixed and be kept so during use. When painting the sole, fill the brush well, let the paint "flow" on, using the brush from side to side, and stroking off from heel to toe in one direction only. The same remarks apply equally to staining.

Polishing Paints or Stains. The method of polishing varies according to the brightness of polish required. Some paints are given only a very light brush; others have a solid-looking polish given. This may be done by the use of gum solution or by means of polishing wax. The method of procedure is to rub over the painted surface with a sponge dipped in the gum, afterwards polishing on the power brush.

Wheel-Bunking. "Bunking," as it is termed, is supposed to set the lip of the channel; more often it is used to hide defective work. If channels are properly laid, bunking is unnecessary, except as a possible means of improving the appearance of the bottom. Bunk wheels may be obtained which make various markings in different widths. The principal point to observe is that the width and character of the wheel mark must be in conformity with the style and finish.

The machine method is to hold the boot up to the wheel and move it round, there being a guard for the edge to rest against.

Crowing. The term "Crowing" applies to the marking put upon the sole to define the difference between the waist and the forepart, or to divide clearly the various styles of finish. Light markings are used on light work, and heavier marks on heavy work. Where marking is used as an ornament to the finish, care should be taken to ensure that it does not detract from or accentuate any distinctive feature. This operation is done entirely by hand, and, therefore, depends upon the artistic skill of the operator.

Beading or Top-ironing. The object of beading is to set up the channel and give a good appearance to the edge of the sole surface. This is attained by melting a small quantity of wax on the edge, afterwards setting up with the lip of an iron, similar in shape to the single-lipped setting iron. The machine method consists of a revolving top-iron, which melts the wax and sets up at the same time.

Trimming Up. The boots at this stage should be ready for polishing off, but, owing to the large number of hands they have been through and the constant taking off and putting on the racks, it often happens that a certain amount of damage is done, and it is the duty of the trimmers up to rectify these defects. Of course, there should be no need for this if care is taken at each stage.

Polishing Off. This is the final operation in the finishing department. Soft cloth revolving pads are used to remove any wax, etc., and soft power brushes are used for polishing. The lasts are now withdrawn and the goods passed forward into the next department for treeing and boxing.

CHAPTER XII

THE STOCK ROOM

THE stock room is a name given to the department immediately following the finishing, or it might reasonably be known as the "Shoe Room," because here the shoes are prepared for dispatch. After having passed through dozens of hands and many machines, footwear of any description must be more or less dirty. As this is the last department in the factory, and blemishes or small defects must here be rectified or the goods returned to the factory, examination for defects is the first procedure. Following examination, the soles are marked or branded, if required. Branding is done by means of a heated countersunk or raised stamp; the latter is preferable, as less pressure is required, an important item when highly-finished bottoms have to be dealt with. The next operation is to clean the linings. No matter how careful the operatives have been, some shoes at least will come through with dirty linings. These defects may be minimized by seeing that the lasts are clean and that the horn of the sewing machine is free from wax, and in other ways.

With machine-sewn work, the next operation is socking, the function of the sock being to cover the stitches, which are coated with wax, and also to cover the heads of the heel pins. The sock should match the lining in colour and must completely cover the insole. In welted work, a full length sock is not required on account of the insole being smooth and clean, but it is customary to use a heel sock. A quick-drying adhesive is used for fixing purposes, and it is usually applied to the back of the sock by a machine that spreads a fine film over the surface.

Cleaning the Uppers. One of the most important operations here is the removal of grease, ink, finger marks, etc., and the process is not easy on account of the many varieties of leathers and fabrics that are used in the production of the uppers. As mentioned in a previous chapter, some leathers are dyed, others have a pigment finish, and others are cellulose-finished, whilst the colours are many and varied. No single cleaner will be satisfactory for every kind of leather, let alone fabrics, and each must have its own special cleanser.

For black leathers, not waxed, a good cleaner is one composed of ammonia, soda, soap, and benzol. If used on dye-coloured leathers the solution would be dangerous unless very much diluted. Pigment-finished leathers are the most difficult to deal with. The original pigment is applied through an alkaline medium, and if an attempt is made to remove finger marks, etc., with an alkaline solution most of the surface colouring on the leather will be removed. Probably the most satisfactory cleaner for this class of leather is one made with Castile soap, although we have heard it said that the best way to clean shoes is not to get them dirty!

Treeing. When the shoes are thoroughly dry the next process is "treeing," or ironing, and the machines used for this purpose are of two forms. For very light work, the feet may be made of rubber, shaped to coincide with the shape of the last and expanded by pneumatic pressure. The machine in general use is known as the "British Treeing Machine," and is made by the well-known last-making firm, Messrs. Mobbs & Lewis, Ltd. The feet in this instance are made of wood, with hinged joints, and are usually one-third of a size less than the actual making lasts. (Fig. 74.)

The treeing is done with the shoes on the feet of the machine, and by means of a warm iron. The iron is passed rapidly over the leather, removing creases by causing the leather to shrink, and generally giving the surface a fine appearance. Care must be taken to avoid too much heat, otherwise the leather will be burnt. In

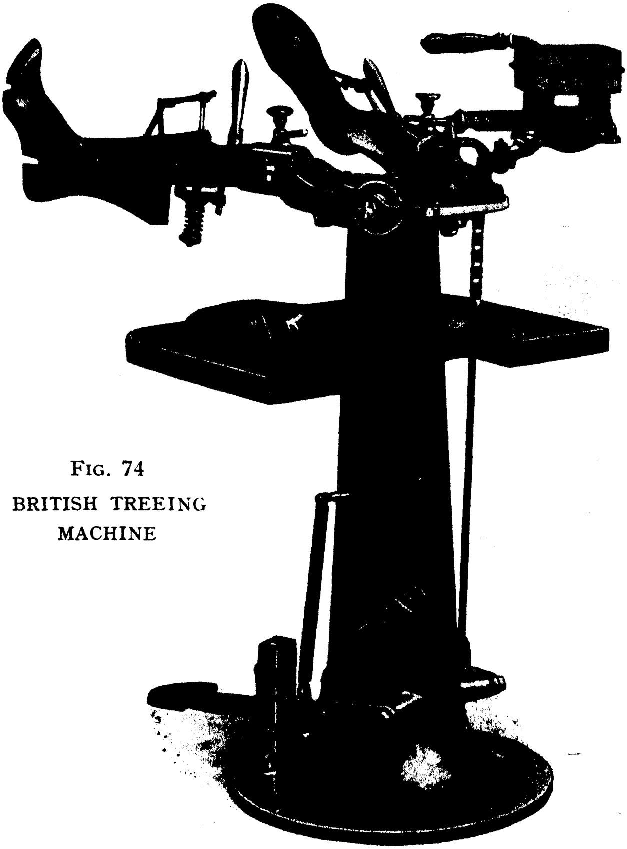


FIG. 74
BRITISH TREEING MACHINE

dealing with light fancy leathers, ironing is not advisable; the use of a soft firm brush should be sufficient for the purpose. Waxed leathers also will not be ironed, for obvious reasons, the desired effect being obtained by using a wood or metal sleeker.

Dressing. In this condition the goods are ready for dressing. Leaving out waxed leathers, one of the most suitable solutions for ordinary black and dark tan colours is comprised of shellac and borax with a suitable colouring medium and water; this is applied with a sponge, and two coats would be necessary. Wax polishes are sometimes preferred, and are more suitable for pigment-finished leathers. The chief constituents of such polishes are beeswax, Carnauba wax, and turpentine. For patent leathers shellac dressings are unsuitable, and it is customary to use either black or white creams, which are made from beeswax, soap, turpentine, and water. The most suitable dressing for pigment-finished leathers is one based upon nitro-cellulose varnish, which is applied by means of an air spray, or, if a cheaper dressing is required, a solution containing fish glue is often used. The shoes are next re-examined and paired up, after which they receive a final polish by means of a mechanical brush and mop. They are now placed in appropriate cartons marked with the size, fitting, and identification number. Next they go on to the packer, or into stock, according to the method of trading adopted by the manufacturer.

Marketing. Several systems of marketing are adopted by British manufacturers. Often the goods are dispatched to large factors, who in turn distribute them among the retailers. A number of manufacturers adopt what is known as the "in-stock" system, and any considerable growth of this method would, in time, eliminate the factor by enabling the small shopkeeper to obtain his goods direct from the source of production. In other cases, large manufacturing concerns own a chain of retail shops in all parts of the country; consequently, their productions are utilized in stocking their own source of distribution amongst the public. There are also a number of multiple shop owners, many of whom do not manufacture a single pair of shoes and whose wants must be supplied by the manufacturer.

CHAPTER XIII

FACTORY MANAGEMENT

THE division of responsibility in a modern factory covers a wide area. In large concerns there would be a board of directors, a managing director, and numerous other officials. In works of what we might term average size, the control of the factory is vested in one man.

Production Management. The responsibility of production usually rests with the works manager. He is expected to establish systems of routine and methods of manufacture, and to control all activities directed towards production. He should have the authority to engage his staff, to control their work, and also to dispense with their services if necessary. He should be, therefore, a man of considerable factory experience, resourceful, tactful, a good organizer, and able to advise upon all matters concerning the technical details of manufacturing. The responsibilities which he assumes are: (1) design and pattern-making; (2) production control; (3) actual production; (4) quantity control; (5) maintenance of plant and equipment.

Design and Pattern-making. The function of design is closely connected with both sales and production management, but owing to the far-reaching effect of the details of design the work is usually regarded as being under the control of the works manager. The work may be said to consist of three distinct parts—

(1) The original designing of the shoe or boot.

(2) The working out of the detail of that design upon a particular last.

(3) The making of patterns for use in the clicking department.

In factories of moderate output the man who is responsible will carry out the whole of the work, assisted by an improver, but in proportion to the output the work is sub-divided.

The designer should have free access to every part of the factory and stores, and should be given every opportunity to follow up his experimental work in the form of samples. The regular filing of catalogues, press cuttings, and illustrations will not only serve the purpose of indicating the tendency of the period, but will often be the means of originating a series of experiments that will pave the way to original designs. Every encouragement should also be given to him to attend displays or exhibitions, in order that suggestive ideas may be obtained.

Under whatever conditions the working patterns are produced, the utmost care should be taken to provide for all the requirements of manufacture, and the peculiar characteristics of materials. Consistent method and close attention to detail are the essential factors in the making of patterns.

The establishment in the pattern room of a card index (or other record) of working patterns, and their details of manufacture, is essential.

Production Control. The responsibility for the treatment of orders is closely associated with, and is sometimes added to, the duties of the works manager. Where a planning system is established in a factory of fairly large output, the duties connected with production control need whole-time attention. Briefly, the work consists of the analysis of orders for materials and equipment required, the production of factory tickets, and the arrangement of the work under conditions that allow of the use of a production programme; all of which is dealt with more fully under the heading of Routine. If the post of production control manager is established, it should be filled by a man conversant with the details of manufacture, possessing good organizing ability and with a capacity for using data.

Actual Production. All those employees whose efforts are directed towards production are under the control of foremen, who, for reasons of discipline alone, should have the necessary power to retain or dispense with the services of operatives according to their efficiency. The production is conveniently divided into sections that are covered by departments, over each of which a foreman is in control. These heads of departments constitute the chief link between administration and labour, and their selection is of the utmost importance. A foreman is necessarily a unit in a large organization, but a general knowledge of the system under which he is working will go far to bring his work into line with the general policy. It is essential that he should have a detailed knowledge of all the processes in the department under his control, and be able to instruct operatives with regard to their work. He should understand his operatives, their mentality, degrees of competency, and their characteristics. Such all-round knowledge is usually gained by hard, practical experience in the factory, and by study. Generally, he has earned his promotion from the ranks, and this is, undoubtedly, the best method of training, since it ensures that he understands the difficulties and the view-point of the operatives.

As the foreman is ultimately responsible for maintaining discipline, it is advisable for departments that initiate, control, and check the production to issue their instructions to the *foreman*, and *not* direct to the operatives.

The efficiency of the factory as a whole is largely dependent upon the treatment of labour, and, consequently, upon the foremen. Perhaps the two greatest factors that affect the respect that is accorded to foremen are efficiency and fairness. It is easy to see that there can be little respect for a foreman who is not thoroughly conversant with the details of manufacture under his control, or who is careless in fixing responsibility when trouble occurs.

Each foreman's responsibilities may be summarized thus. He is responsible: (1) for the efficient use of materials, to the works manager; (2) for the quality of work, to the quality supervisor; (3) for the quantity of work, to the production control manager; (4) for departmental organization and discipline; (5) for the training of labour.

Quantity Control. This is another responsibility that the works manager is often expected to bear. If, however, the production warrants the establishment of the post of quality supervisor, it should be filled by a man who is a thoroughly good shoemaker, conversant with all departments of the factory, and who will hold himself responsible for the quality of production with regard to both materials and workmanship. He should set up, and use regularly for comparison, certain standards of quality for materials and workmanship. In co-operation with the works manager, he should draw up specifications of materials and operations.

Maintenance of Plant and Equipment. A maintenance engineer is usually appointed to carry out the general inspection of and repairs to the plant and equipment, and, in the case of a large factory, he will require assistance. The work is very wide in its scope, and needs to be carried out by a person who has had a thorough training in general engineering and, in addition, has acquired a useful knowledge of electric power and lighting systems.

Although minor repairs may be accomplished by the maintenance staff, it will be necessary from time to time to employ outside service engineers to carry out specific repairs in machinery.

Factory Routine. When reviewing methods of factory routine it is necessary to keep in mind certain general facts and principles. In the first place, we must remember that the permanent success of the business depends upon giving *efficient service.* This consists of manufacturing goods at competitive prices, by uniform methods, and in the shortest possible time consistent with good shoemaking. To do this effectively it is necessary to establish methods that promote economy in the use of materials, control that ensures consistent practice, and a system that takes care of the progress of the work. Also, it must be remembered that any and every system of organization that might be adopted is only justifiable as an aid to production, and that in all circumstances such organization is only a contributory service. If this fact is thoroughly appreciated the extent to which the organization is developed will be governed by the size of the business and the type of work transacted.

If it has been decided to manufacture for large factors, or as a basis for multiple shops (which may involve the establishment of an instock system), then the factory orders are likely to be of a fairly regular nature, and to permit of manufacturing somewhat upon mass production lines. If, on the other hand, orders are obtained direct from retailers and small factors, variety is of much more importance than quantity, and entirely different conditions arise, demanding different treatment.

For the purpose of illustration, the two sets of conditions outlined will be considered as distinct types, but it will be readily appreciated that the distinction is not always definite, and that peculiar circumstances may alter the procedure.

Outline of Procedure when Orders are Small and Irregular. 1. Orders are received, checked for accuracy of detail, acknowledged, and registered.

2. Master and supplementary tickets are made out from the orders, to comply with sample specification.

3. The tickets are sent to the clicking department in rotation as far as possible, and, unless wanted urgently, the orders pass through the factory more or less in the sequence of the receipt date.

4. As the work passes through the various departments, the details of manufacture are obtained from the ticket supplied, or from departmental description books to which the ticket refers.

5. The work is booked out of each department upon completion, and this forms a record by means of which it is possible to trace the position of any line of work during manufacture.

6. Tear-off coupons for piece-workers, and work-sheets for day-workers, are generally used for the purpose of wage and cost accounting.

Although many firms necessarily employ this or a similar method of routine, there are certain features which are not conducive to the highest efficiency. The system throws the responsibility of routine and actual sequence of order upon the foremen, who are apt to take a short view, limited by the possibilities of their own departments, of economic production. Also, the time taken for production will vary considerably, thus making it almost impossible to promise a delivery date with any certainty of fulfilment.

There are very many varieties of this type of routine, some simple, others elaborate, but all those systems that are not based upon an actual production programme are intended to be included under this heading.

Outline of Procedure where the Demand is Large

Enough and of Sufficient Stability to Establish a Planning System. This method—sometimes known as the Day Sheet System of Production Control—is based upon a manufacturing schedule or programme, together with the necessary organization by means of which the plant, labour, and materials are used to the best advantage. The complete system involves much detail, of which only a brief outline is given here.

As orders arrive they are first approved for credit by the accountant and passed to the order clerk. He proceeds to check the order for accuracy and enters the main details in an order register. The orders are then passed to the production office, and submitted to a first analysis for last and style in order to fix the date of entry into factory production. This first classification may be efficiently carried out by the use of capacity cards; each card represents a period (say a working week), and shows the production capacity of the factory on different styles and lasts. The orders are recorded on this card until the capacity on the particular style has been absorbed, when the remainder are placed upon the card for the following period. This determines the earliest period within which it is possible to put these orders into the factory. All the routine just described should be followed immediately upon receipt of the orders, and an acknowledgment, together with a delivery date, if required, should be posted by return.

Materials Analysis. It is essential to this system that all materials shall be to hand before they are actually required; hence it is necessary that orders shall be analysed for materials at the earliest opportunity. This is carried out in respect of upper and bottom materials, and, generally, for other materials that are peculiar to a certain style or sample. The requirements are set against the balance as shown on the stores index cards, and, if necessary, requisitions for further stock are sent to the buyer.

Making Factory Tickets and Tags. The detailed information concerning the manufacture and cost of each sample may be usefully recorded by means of card indexing, and such data are then in a convenient form for transferring to factory tickets and tags. It is usual to make a master ticket for each line of work (say, of twenty-four pairs), containing a complete description of materials and processes, and also several supplementary tickets, which are duplicates of the master ticket in respect of certain sections of manufacture; thus allowing several components of the shoe or boot to be prepared at the same time. The items on the tickets are usually printed and the description is either written by hand or machine. In the latter case duplicates of the master ticket are sometimes made on different coloured flimsies, and are used as supplementary tickets.

As the responsibility for correct manufacture is transferred to foremen and operatives by means of these tickets, their construction deserves the most careful attention. The whole process of supplying information is very much simplified if codes are used freely for materials and operations.

Actual Planning. Having made out these production tickets, the next process is that of arranging the tickets in such a way that materials, labour, and plant are used to the best advantage. To do this, it is essential to have, indexed, detailed information of many kinds gleaned from the whole of the factory. Generally, this consists of capacities of plant and labour as well as details of the minimum safety stocks that are held in the stores. In addition, the availability of lasts has to be considered; this should take the form of a continuous record of their use, which is compiled as the orders are planned, and should include total stock, particulars of size and fitting, etc., as well as the available balance.

With this indexed information, it is possible to take the tickets representing the work on a capacity card and sort them into groups (sufficient for a day, or half-day) of such variety that most of the operatives and plant will be employed at full capacity.

Day Sheets. Each line of work in each group is given a consecutive number, which is stamped upon all related tickets. The various lines of work in each group are then listed upon a sheet, and this is known as the day sheet or half-day sheet according to the way in which the production is divided. At the top of the day sheet the name of the department is written, and the date upon which the sheet should enter production and leave the department. It is convenient to key the consecutive number on the master tickets with that of the day sheet, and an additional advantage is gained if all tickets belonging to one sheet are of a distinctive colour.

About sixteen copies of each day sheet should be made in order that they may be placed in the hands of persons at checking stations in addition to the heads of departments. These checking stations are best situated at the beginning and end of each department. Copies of each day sheet should be given out *at the same time* and kept on a file in date order. It is most important that the sheets should retain their original order, and that no sheet should be returned to the office until the work it represents is complete. If a column for labour values is added to each day sheet the result of the departmental working may be calculated and recorded very easily.

Time Allowance Schedule. It has already been stated that the whole system is based upon a manufacturing schedule or time programme that makes a definite allowance of time for the work to pass through a certain number of operations.

This time allowance should be determined after careful consideration of the most economical factory unit of work, the class of work, the operations included, and the condition of the work at various stages of manufacture. It is generally considered that twenty-four pairs constitute the most useful unit, and the most useful production programme is based upon twelve to fourteen working days. Once this schedule has been decided upon it should not be changed except in the most pressing circumstances. The shortening of the schedule carries with it many advantages, but on no account is it advisable to reduce the allowance to the detriment of the workmanship.

To carry out this planning, a factory calendar must be established, and when each day sheet has been planned in and out of each department on this calendar, the necessary dates are transferred to the day sheets.

Rush and Special Work. It is obviously unwise to plan the work of the factory right up to 100 per cent of the capacity for the usual run of work; and the margin allowed, which, of course, will differ under certain conditions, provides for the carrying out of small rush and special orders which occur with every type of business. The best method of dealing with the problem is to sheet this work on a special schedule, and make out all tickets, etc., in a distinctive colour. A bright red should be sufficiently disturbing to command attention.

CHAPTER XIV

RESEARCH AND EDUCATION

Research. The British Footwear Industry was one of the first in the country to realize the opportunity offered by the Government immediately after the War, when a sum of money, known as the Million Fund, was placed at the disposal of the Department of Scientific and Industrial Research, to be used for the encouragement of the application of science to the industries of the country. In 1919 the British Boot, Shoe, and Allied Trades' Research Association was formed. In its early days its membership did not extend outside the town of Northampton, and until the end of 1922 its headquarters remained in that town. The beginning of 1923 saw the transference of headquarters to the Metropolis, and since then the activities of the Association have continually developed. Its membership has increased at a steady rate, and to-day its work is exercising considerable power and influence throughout the whole of the industry.

There is a growing realization on the part of manufacturers, and in fact all members of the trade, that to hold its own in the markets of the world the industry must organize the application of science and scientific method to its processes. The Research Association's policy has always been framed on broad bases covering all the important problems with which the industry is confronted. With the growing support from the manufacturers and other sections of the industry, it is possible to prosecute the work with continually increasing vigour, and it is to be expected that before very long the Research Association's influence throughout the trade will be of a magnitude little dreamed of by some of the pioneers of its formation.

The research policy can here be indicated only very briefly. For the present purpose we may regard the shoe factory processes as divided into two broad categories. There are those processes by which a first model is produced. With such model, orders are obtained. Then comes the question of bulk reproduction—the second group of processes. To produce the first model the initial requirement is the selection of a last suitable for the market for which the model is intended. To select a last appropriately requires considerable knowledge of the feet in the market concerned, and also of the designs of lasts for different kinds of footwear. The Research Association contends, probably quite rightly, that this industry, which, comparatively speaking, has grown up very rapidly and recently out of the old-time craft, does not possess an adequate method of specifying the foot. All industrial history indicates that as industries move towards large scale production and scientific control there is an increased use of standard specifications. The most fundamental thing with which this industry has to deal is, of course, the foot, which it is its purpose to clothe. Yet the industry does not possess a method of specifying a foot in regard to its type and to those characteristics of which a knowledge is essential to good shoemaking.

One of the most important pieces of work which the Research Association has undertaken, therefore, relates to this very thing: to find a method of measuring a foot that is simple and concise, yet comprehensive in the sense that it does, as it were, take hold of and specify the essential characteristics. The results of this research have their influence in the first broad category mentioned above, the production of the first model, for when a method of measuring a foot has been worked out, the measurement of large numbers of feet and the careful analysis and study of such statistics lead to the specification of groups of feet. It is obvious that the application of research of this kind throughout the world will give the industry that knowledge of feet which it requires to be able to produce first models suitable to any possible market in the world.

The Research Association has also worked on the subject of last design.

Under the broad heading Bulk Reproduction, there is scope for a considerable amount of research. If large numbers of shoes are to be made, obviously the first requirement is for large amounts of materials. An outsider would be amazed to see how many different kinds of materials there are in a shoe factory storeroom. There are, of course, the many different kinds of leather, but besides leather there is a multitude of articles—fabrics, threads, tacks, polishes—of which the ordinary man in the street would hardly dream. Again, probably because the industry has grown up rapidly, it is a remarkable thing how very few indeed of these many articles are bought by the shoe manufacturer to specification. The buying of leather is still largely controlled by the empirical judgment of the leather expert, the man who has been handling leather for a lifetime. The Research Association has recognized the opportunity presented by this state of things and has done a considerable amount of work on the specification and quality control of shoe materials.

When the materials are bought and are in the factory, many problems arise in connection with the handling of them, the economic cutting of them and the care needed to get the best out of them. Patent leather may be taken as an example. This is a troublesome material to use, for it is liable to crack whilst being manipulated into shoes, necessitating subsequent repair, which naturally increases the cost of patent leather shoes. How to treat patent leather to minimize this trouble is an obvious problem, and the Research Association has been able to give advice in this connection which has resulted in very considerable benefit to all makers of patent leather shoes.

This is perhaps sufficient to indicate the broad scope of the Research Association's activities. Its researches are recorded in printed reports which are circulated to members of the Association. In the first place its work is private and confidential, for the information only of its members. This is natural, but its Council of government takes the generous view and frequently releases reports for general circulation. In particular, information concerning work that has been done on leather has been published for the benefit of the whole of the leather industry, usually in the *Journal of the International Society of Leather Trades' Chemists.*

There is another side to the Research Association's work that is of immense importance. That is its bureau of information, or consultative bureau. Members are at liberty, in fact they are encouraged, to use the Research staff in a consultative capacity, so that any member who takes advantage of this service practically adds to his business a new department by the outlay of a comparatively small annual subscription. Firms in the industry are beginning to realize how valuable this is, and many make very frequent use of the scientific staff to solve problems that are arising daily in the various departments.

Naturally, through these activities the Association is accumulating an immense amount of valuable information and experience, a fund of knowledge from which every member is at liberty to draw. It must be obvious to all thinking people that a co-operative scientific organization like the Research Association, which is all the time collecting, collating, indexing, and filing information of value to the trade and obtaining fresh knowledge from its own researches, is an organization which in these modern days the industry *must* possess if it is to hold its own in world competition, and no far-seeing business man will withhold his support.

Education. *The National Institution for the Boot and Shoe Industry.* The National Institution for the Boot and Shoe Industry was established in 1927 with registered offices at 7 Tavistock Square, London, W.C.1. The Right Hon. Lord Buckmaster, P.C., G.C.V.O., has been President of the Institution since its inception.

Whilst for many years there have been technical schools and colleges in almost every boot and shoe centre in the country, the need gradually became apparent not only for closer co-operation between those responsible for the direction of the shoe industry and technical education and research, but also for closer working co-operation amongst the schools themselves. In the past boot and shoe technical schools have been more or less a law unto themselves, conducting their own examinations, apart from the City and Guilds of London Institute, and granting their own certificates, which were mainly of local value. It was intended by the promoters that the National Institution should assist in co-ordinating these various local efforts and raise them to a higher standard, and that in time manufacturers would come to regard the distinctions conferred by the Institution as of national importance. Considerable preliminary work was necessary before the National Institution was finally launched, for many conflicting interests had to be reconciled. The co-operation of the Board of

Education was secured at the outset, and amongst others consulted were boot manufacturers from most of the centres, local education authorities, the principals of technical schools and colleges, the Boot Trade Research Association, and representatives of the Operatives' Union.

The principal objects of the National Institution were summarized by the Board of Trade upon its establishment in these terms—

1. To promote the general advancement of knowledge in the boot and shoe industry, and to foster the systematic study of problems that are of interest to the industry as a whole; and

2. To promote technical education in the industry and to encourage students to pursue their general and technical studies to the highest standard attainable.

Whilst as yet the National Institution does not hold its own examinations, the Council has formed an Examination Committee, whose duty it is to ascertain and determine the ability and qualifications of students who desire to become members of the Institution. The Examination Committee may also draw up and approve syllabuses, and approve courses and examinations of other bodies. It is not too much to say, however, that the Institution attaches more importance to the course of study followed and to the way it is followed than to actual examination results.

Members are divided into Full Members and Associate Members. There are five classes of Full Members, viz., Permanent Members, Life Members, Subscribing Members, Honorary Members, and Fellows. There are two classes of Associate Members, viz., Associates and Student Associates.

A Student Associate must have attended an approved technological course for not less than three years, and hold a certificate from a college or school showing that he has maintained an approved standard for attendance and homework, and that he has passed approved examinations in technology and general education.

An Associate must be 21 years of age and must have completed an approved course of technological study, gained an approved certificate in the technology of the industry, and passed such other tests as the Institution may impose upon Associates. A Fellow must pass the fellowship tests of the Institution and at present must have been an Associate for five years, except in cases specially exempted by the Council.

The Institution, however, envisages a much wider field of activities than simply admitting to membership those who qualify for its awards and distinctions. It seeks to encourage originality and research and towards this end central meetings have been instituted at which questions affecting the boot and shoe industry are examined and discussed. At these meetings papers are read on subjects of technical and scientific interest to the industry and are followed by discussion. A link between the central meetings has been established by the formation of local branches in the various boot and shoe centres, and it is anticipated that this development, which was inspired in some measure by the members themselves, will assist in the fostering of technical and scientific interests amongst the members, and serve also as the preparatory ground from which will spring the Fellowship theses of the future.

The Institution has its own Journal through which up-to-date literature for the industry will be gradually built up. During the last year, a survey has been made of books and other literature of educational and technical importance to boot and shoe manufacture in this country and abroad, from which a bibliographical index has been compiled. Also the Institution makes a collection regularly for foreign trade papers, from which members are invited to abstract articles of general trade interest.

On the whole the National Institution has made considerable progress since its inception three years ago. Up to the present it has mainly attracted the older members of the industry, but its chief influence in the future should be with the youths entering the industry, so that they may be encouraged to continue their general and technical studies from the school-leaving ages of 14 and 16 up to the Fellowship standard that the Institution requires. The modern method of manufacture of boots and shoes constitutes one of the most highly specialized industries of the present day, and the maintenance of the position of the British shoe trade in the markets of the world depends very largely upon the application of the latest technical knowledge and skill, and upon our being able to get highly-trained labour. It is this work that the National Institution seeks to encourage.

CHAPTER XV

THE RELATION BETWEEN CAPITAL AND LABOUR

No book on the boot and shoe industry would be complete without some reference to the governing bodies representing the manufacturers on the one side and the operatives on the other. The National Amalgamated Union of Operative Boot and Shoe Riveters and Finishers was founded in 1874 and changed its name to "The National Union of Boot and Shoe Operatives" in 1890. The employers founded the National Manufacturers' Association in 1879 and this afterwards changed its title to the present one, "The Federated Associations of Boot and Shoe Manufacturers of Great Britain and Ireland."

Although a matter of history, it will be interesting to note the relations between the two bodies prior to 1895. During the year 1894 grave differences of opinion existed between the Employers' Federation and the National Union. At this time wages were low and unemployment rife, and the employers were desirous of adopting the "team system" at what were considered unremunerative wages. These conditions were brought about by the introduction of vast quantities of machinery, and were the prime factors causing unrest. In the early part of 1895 the National Union served notices on six firms at Leicester, claiming a minimum wage of 28s. per week for clickers and 26s. per week for pressmen. They also wanted to abolish the custom of sending work into the country villages. Notices were at the same time sent to three firms at Northampton regarding a revised statement for welted work.

The trade was now face to face with a great crisis; the National Union were prepared to submit all questions to arbitration, but the Employers' Federation would submit only a few of the points in dispute. Had they been willing to arbitrate on all the questions of dispute, the great lock-out of 1895 would probably not have occurred. The struggle lasted for several weeks and affected the shoemaking centres in all parts of the country.

One of the results of the dispute was the flooding of the home market with boots and shoes, chiefly from the United States, and for a long time afterwards the result of this was apparent. Up to this period there is no doubt that the relatively low wages paid to the operatives did not induce boys and youths of good education to enter the trade. Gradually new conditions were evolved, and by the introduction of modern machinery and modern methods, the home manufacturer began to hold his own; a year or so later foreign shoes were to a great extent driven from the market.

Much of the success of recent years is due to the good relations between capital and labour, together with the rapid growth of technical education for master and man. The conciliatory spirit began with what is known as "The Terms of Settlement," which were drawn up at the termination of the lock-out. The principal of a number of resolutions agreed to comprised the appointment of a joint committee of employers and workmen to fix piece-work prices for machine workers, based upon the capacity of the average workman.

The local Boards of Arbitration were reconstituted, consisting of equal numbers from both sides. Such Boards had full powers to settle all questions concerning wages, hours of labour, condition of employment, etc. Provision was also made to submit any point that could not be agreed upon by the Boards to an independent arbitrator. It was agreed by the said "Terms of Settlement" that no strike or lock-out should be entered into on the part of any body of workmen or members of the National Federation.

As a guarantee for carrying out the provisions agreed upon, each side deposited £1,000. In case of any dispute leading to a cessation of work, either side could claim damages from the fund, providing work was not resumed after three clear days' stoppage.

Several alterations or additions to the "Terms" have been made in recent years, and up to the present no serious dispute has broken the harmonious relations that have existed for the past thirty-five years. Some idea of the relationship between the two bodies may be gained if we quote the following, which was published broadcast in November, 1925—

> The Joint Industrial Council for the Boot Manufacturing Industry supports Clause 6 of the Preliminary Conference Agreement, September, 1913, viz.—
>
> For the more effective enforcement of any agreements, awards, or decisions, as well as for the general advantage of the industry, the Federation and the National Union equally recognize the importance of their respective organizations being as numerically strong and as fully representative as possible of employers and operatives in all centres of the shoe trade, and is of opinion that the best interests of the industry will be served if all manufacturers can be encouraged to join the Boot Manufacturers' Federation and all operatives encouraged to join the National Union.

Had other industries copied this example, the whole history of British industrial life might have been vastly different from what it is to-day.

The members of the National Union usually select broad-minded men to represent their views, and although a policy of "give and take" is often necessary, and in some instances probably disappointing to the members, they realize the advantage of discipline, and it is now a rare occurrence for a body of men to disregard the advice of their leaders.

Undoubtedly wages have been kept down by the action of a certain class of factor, or middleman. It is no uncommon rule for orders, taken by the factor, to go straight from the factory to the retailer, the factor, of course, taking a toll on the goods, which have not even entered his premises. Price cutting, or keen buying, as it is termed, is also a feature of the business methods of such firms.

Although piece-work statements are in vogue in most centres of the industry, there is a recognized minimum wage rate for a 48-hours' week, based upon the index figure of the cost of living compared with the pre-War period. For male operatives, with the index figure at 70, the rate of wages is 56s. per week, and for female operatives the rate is 34s. per week. If and when the index figure drops to 50 points, the rate will be 54s. per week for males and 33s. per week for females. A graduated scale for male operatives under 22 years of age, with twelve months' experience, and at the same index figure, 70, commences at age 15 with 13s.; age 18, 27s.; age 20, 40s.; age 21, 50s.; and age 22, the full minimum. For females the scale commences at 12s. at age 15, and reaches the full minimum at age 20.

Boy Labour. Regulations concerning juvenile labour apply to specified departments. In the clicking, press, lasting, and finishing departments, the proportion borne by the aggregate number of boys to the aggregate number of men employed throughout those departments must not exceed one boy to every four (or fractional part of four) men, but in no one of those departments must the proportion exceed one boy to every three men. The expression "boys" means male operatives under 19 years of age, and the expression "men" means male operatives of and over 19 years of age.

The ramifications of the National Union increase, and, although they cannot be compared in size to some of the larger in the labour movement, increasing numbers must be very gratifying to the officials. Previous to the outbreak of war, the total membership would be about 48,000; at the present time the number has increased to over 80,000.

Holiday Scheme. Another innovation and, until recently, one not common to other industries, is the provision of a "Holiday Scheme." The Joint Industrial Council for the Boot and Shoe Trade, on 27th May, 1919, adopted a contributory holiday scheme based on equal contributions from manufacturers and operatives, and the scheme was incorporated in the National Conference (1928) agreement. At the present time the weekly contributions are as follows—

	Men (over 21)	Youths (18–21) Women (over 20)	Boys (16–18) & Girls (16–20)
Employer	1s. 2d.	8d.	8d.
Operative	1s. 2d.	8d.	8d.

Assuming the operatives have a full week's holiday, they would draw, on the first pay day after the holiday, or at other times, according to arrangement, 40s., 20s., and 10s. respectively.

Naturally there must be certain regulations connected with the scheme to make provision for the inherent weakness of human nature, but taking this scheme in conjunction with other striking features of agreement between both parties, one must feel proud to be connected with the industry.

In every centre of the industry a majority of the manufacturing firms belong to the Employers' Federation.

There are still a number not federated, and in the interests of the industry it is to be hoped the non-federated firms will, before long, see the error of their ways and voluntarily become members of the Federation.

There is no better shoemaker than the British operative. Given a continuance of the good relations between capital and labour, with fair and reasonable conditions of trading, there is no reason why the boot and shoe industry should not continue to hold its own in every quarter of the world.

INDEX

ALBERT slipper, 31
Allowances, lasting, 42
——, seam, 43
——, stiffener, 41
Area measurement, 71
Attachment, methods of, 137

BELLIES, 99
Bends, 99
Blake-sewn, 152
Bottom buffing, 173
—— burnishing, 178
—— scouring, 172
Boy labour, 208

CHARACTER of bottom leather, 97
—— of skins, 68
Circular vamp, 38
Cleaning, 183
Colouring edges, 81
Creaking, 136
Cutting, direct, 105

DAY sheet system, 193
Derby quarter, 40
—— vamp, 41
Designing, 37, 187
Dead method, 119
Drafting, 118
Dressing, 185
Drying, 166

EDGE setting, 174
—— trimming, 166
Edges, upper, 82
Education, 201

FABRIC cutting, 52
Fabrics, 50
Factory management, 187
Filling, 135
Folding, 79
Forme cutting, 24
Fudging, 173

GRADING, 43
——, bottom stock, 111
Grinding cutters, 168

HEELING, 157
Heel burnishing, 176
—— paring, 165
—— scouring, 169
Heels, 161
Hides, division of, 99
——, origin of, 97
Hoisted, 119
Holiday scheme, 209

INKING, 173
Insole, construction, 35

LAST fitting, 12
——, measurement, 10
——, types, 8
Lasting, 117
Laying, sole, 143
Levelling, 157

MACHINE lasting, 123
Marketing, 185
Materials analysis, 193
Measurements, 10
Methods of attachment, 137
—— of buying skins, 70
—— of closing, 86
Mulling, 166

NEEDLES, 95

ORDERS, handling of, 192

PAINTING, 180
Pattern-making, 187

Pegged work, 150
Perforating, 80
Piece-work statements, 208
Pitch, of last, 6
Plant and equipment maintenance, 190
Pleating, 120
Ploughing, 165
Pounding, 132
Preparation of patterns, 46
Principles of cutting, 65
Production control, 188
management, 187
Pulling over, 127

QUANTITY control, 190

RADIAL tool, 44
Ranging, 104
Research, 197
Riveted goods, 149
Rolling, 103
Rounding bottom stock, 99
—— skin, 56

SCREWED, 155
Seams, upper, 84
Selection of material, 67
Shape of skins, 56
Shoulders, 107
Skiving, 75
—— machines, 78
Spring, of last, 7
Standard boot, 34
—— construction, 28
—— Court shoe, 30
—— shoe, 32
Stitch formation, 92
Stitching materials, 94
Straight golosh, 39
Strain in uppers, 59
Stretch, 55
Substance, 58
Substitutes, 101
Systematic cutting, 60

TABLE of points, 33
Tacking, 120
Team system, 133
Temporary attachment, 150
Terms of settlement, 206
Tight, 57
Time allowance schedule, 195
Treatment of edges, 82
Treeing, 183
Trimming edges, 166

VELDTSCHOENS, 138

WELTING, 140
Wetting, 103

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